REPORT RESUMES

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THE TEACHING OF COLLEGE ENGLISH TO THE SCIENTIFIC AND TECHNICAL STUDENT. FINAL REPORT OF THE COMMITTEE ON COLLEGE ENGLISH FOR THE SCIENTIFIC AND TECHNICAL STUDENT, NATIONAL COUNCIL OF TEACHERS OF ENGLISH.

BY- ESTRIN, HERMAN A. AND OTHERS

NATIONAL COUNCIL OF TEACHERS OF ENG.,CHAMPAIGN,ILL

PUB DATE 28 NOV 63

EDRS PRICE MF-$0.50 HC-$3.40 83P.

DESCRIPTORS- *TECHNICAL WRITING, *ENGLISH INSTRUCTION, *PROGRAM EVALUATION, *HIGHER EDUCATION, *INDUSTRY, ENGLISH, COLLEGE STUDENTS, WRITING SKILLS, EDUCATIONAL RESEARCH, SURVEYS, STUDENT CHARACTERISTICS, TEACHER EDUCATION, STUDENT EVALUATION, TEACHER EVALUATION, TEACHER CHARACTERISTICS, CURRICULUM EVALUATION, COURSE CONTENT, BIBLIOGRAPHIES, TECHNICAL EDUCATION, SCIENCE EDUCATION,

THE COMMITTEE PREPARED A REPORT ON TECHNICAL AND SCIENTIFIC STUDENTS--THEIR ENGLISH TEACHERS AND ENGLISH CURRICULUM--AS WELL AS INDUSTRY'S NEED FOR SUCH STUDENTS. THE INTRODUCTION DISCUSSES THE ROLE OF HUMANITIES IN THE SCIENCE AND ENGINEERING CURRICULUM. TWO CHAPTERS DISCUSS THE BACKGROUND, ATTITUDES, AND INTERESTS OF BOTH THE STUDENTS AND THEIR ENGLISH TEACHERS. A THIRD CHAPTER IS BASED ON A STUDY OF THE ENGLISH COURSES WHICH TECHNICAL AND SCIENTIFIC STUDENTS TAKE. THE RATIONALE, TEACHING METHODS, PURPOSES, AND TEXTBOOKS FOR COURSES SPECIALLY DESIGNED FOR THESE STUDENTS ARE DESCRIBED, AND A MINIMUM ENGLISH PROGRAM IS SUGGESTED. A FOURTH CHAPTER ON INDUSTRY'S NEEDS DISCUSSES WRITING AND SPEAKING ACTIVITIES REQUIRED IN BUSINESS AND INDUSTRY AND EVALUATES BOTH THE STUDENTS' COLLEGE TRAINING, AND THE TECHNICAL WRITING COURSES OFFERED IN COLLEGE. A BIBLIOGRAPHY FOR STUDENTS AND TECHNICAL WRITING TEACHERS IS ALSO PROVIDED. (BN)

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TE 500 029

The Teaching of College English
to the
Scientific and Technical Student

Final Report of the Committee on College English

for the Scientific and Technical Student

National Council of Teachers of English

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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Dr. Herman A. Estrin, Chairman,
Committee on College English for
the Scientific and Technical Student, NCTE
Department of English and Humanistic Studies
Newark College of Engineering
Newark 2, New Jersey
November 28, 1963

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Committee Members

Chairman - Herman A. Estrin, Newark College of Engineering

Associate Chairman - Michael Adelstein, University of Kentucky

Consultants - Edward Foster, Georgia Institute of Technology

Samuel Bellman, California State Polytechnic College

Burton Fryxell, Michigan College of Mining

William Mullen, Georgia Institute of Technology

Kline A. Nall, Texas Technological College

Verna L. Newsome, University of Wisconsin - Milwaukee

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Grady C. Stubbs, General Motors Institute

Autrey Nell Wiley, Texas Woman's University, *ex officio*

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The Technical and Scientific Student - Dr. Kline Nall

The English Teacher of Technical and Scientific Students - Dr. Michael E. Adelstein

The Technical and Scientific Curriculum

- A Survey of the Teaching of English to Engineering and Science Students - Dr. H. A. Estrin
- A Minimum English Program for Technical and Scientific Students - Dr. Michael E. Adelstein

Industry's Need - Professor Grady Stubbs

- Industry Speaks Out---To the Instructors of English - Dr. H. A. Estrin
- Corporation Writing Survey - General Motors Institute
- Writing and Speaking for Business and Industry: A Survey of Fifty New Jersey Engineering Companies - Dr. H. A. Estrin
- Writing Situations in Aircraft and Aerospace Industries - Dr. Fred MacIntosh

Bibliography - Dr. H. A. Estrin

- Suggestions for More Effective Writing: Articles and Books
- Reference Works: General Dictionaries, General Style Manuals, Technical Aids, Graphic Aids
- Technical Writing Programs
- Technical Writing in the Professional World
- Masterpieces of Science and Engineering
- Bibliography for Instructors Interested in the Humanistic-Social Curriculum of Engineering Education

Introduction

The Committee on College English for the Technical and Scientific Student (1960-1963) adopted the following purposes:

1. To learn the attitudes and backgrounds of the scientific student
2. To survey the course contents of college English for the scientific and technical students.
3. To learn the attitudes, background, and experiences of the instructors of college English for the scientific and technical student
4. To impart the most effective methods of teaching English to scientific and engineering students
5. To prepare bibliography for outside reading for scientific and engineering students
6. To serve as a liaison with industry in order to learn its needs for scientific and engineering students concerning writing, speaking, and reading
7. To survey the field of textbooks in English communications relating to scientific and engineering students and to make annotations for teachers of these subjects
8. To survey scientists and engineers in the field to ascertain what should be emphasized in the field of English communication
9. To motivate scientific and engineering students to enjoy and appreciate the humanities
10. To evaluate courses of English communication which scientific and engineering students are pursuing
11. To discuss standards for the measuring of the quality of teaching English to scientific and engineering students

With these purposes the Committee, which represented the various geographical areas of the country and the different kinds of colleges and universities--state universities, military academies, urban colleges, institutes, junior colleges, prepared this report to discuss the most recent information concerning the following:

1. The Technical and Scientific Student
2. The English Teacher of the Technical and Scientific Student
3. The Technical and Scientific Curriculum
4. Industry's Need
5. Bibliography

The Need for the Study: As Viewed by Industry

The Esso Research and Engineering Company and the Esso Standard Oil Company asked 2,500 engineers these questions:

> How well are students being equipped for engineering work in industry?
>
> How might undergraduate courses be modified so that future engineers will be even better prepared?

Nearly all the engineers agreed that they had a solid background in engineering calculation principles and that, while at college, they had acquired a code of professional ethics; however, when asked in what areas their college preparation was inadequate they agreed on one point:

> The greatest weakness in their college training was in the whole field of written and oral communication.

The respondents in this survey stated that all written communication was the responsibility of the English Department; however, if it is to be really effective, it must be the concern of all departments. For example, if a student received a lower grade from his engineering instructor for ineffective writing in an otherwise excellent report, the student would realize the importance of accurate composition. While in college, students should receive from all their instructors the motivation to learn to write.

The General Electric Survey[1] bore out results similar to the Esso survey and applicable to the teachers of college English to technical and scientific students. Approximately 13,500 college graduates employed by General Electric Company participated in this survey.

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[1] General Electric Company, *What They Think of Their Higher Education*, Educational Relations Bulletin, January, 1957.

When asked the areas of college study that contributed most to their present position of responsibility with the company, the great majority of the non-engineering group reported that the most helpful and valuable subject area was English communication. Both written and spoken English were cited as of extreme value in business success. Engineers listed English second to mathematics.

In the ranking of courses most recommended for management responsibility, both engineering and non-engineering graduates placed English at the top of the list. In addition, in the ranking of courses reported most valuable for leisure time, engineering graduates listed English literature first.

Engineering Students (evening)

In an English class taught during the evening, the author requested his students who had positions as technicians in the field of engineering to analyze the worth of their study of English in relation to their daily technical work.

Each of the following conclusions is substantiated by the student's reaction stated in his own words:

1. This is the Paperwork Age. Reports of all kinds are necessary, and the engineer must express himself accurately and concisely.

> The engineer of today's modern world must be able to write letters, assignments, descriptions of the mechanical operation of new parts, and reports on the progress of his work. All of these must be written so that they can be understood and retained by the reader after one or two readings.

2. The engineer must communicate with others besides engineers, i.e. laymen and other professional persons.

> Speaking the English well and fluently is certainly a great asset to any engineer. In this world today, there are a great number of men who do not have the ability to speak before a group

of people. Therefore, when this asset is found in an engineer, it makes him more valuable to his fellow workers, to his community, and to his employer. Any engineer who has the ability to speak and to write well will never have to look far for a position with a company of his choosing.

3. Especially in the field of sales engineering, the knowledge of English is a must.

A sound working knowledge of the English language is essential to become an effective sales engineer. In his contacts with prospective buyers, he must be able to speak with intelligence, write with authority, and read with understanding. Along with speaking, writing, and reading he must possess cultural knowledge to be entertaining in the many social engagements that he has.

4. Many engineering developments are circulated in memoranda. Therefore, the engineer must have a knowledge of the principles of correct writing.

In the technical field the ability of one to compose well-constructed memoranda is a very definite attribute, while the person who cannot gather his thoughts and set them down on paper in an intelligible manner is very definitely handicapped. The use of technical memoranda in many organizations is an important means of distributing new knowledge and information regarding the company's latest developments and ideas. The importance that industry places on correct writing can be realized when we consider the vast amounts of money spent annually by industry to teach and train their employees these techniques.

5. Engineers must talk before groups and must give information orally about their new developments or discoveries in a clear-cut, understandable manner.

Speaking plays an important role in engineering fields. For example, a new development or discovery can create many inquiries from interested people. The engineer who is responsible for creating this interest may be called on to give a talk about his development or discovery. For this reason it is important that an engineer should have a good command of the English language and have the ability to organize and present his talk intelligently. His presentation will undoubtedly be a direct reflection upon himself and the company which he is representing.

6. In many cases, salary increases are annually determined primarily by the quantity and the quality of the memoranda that are spoken and written during the preceding year.

The importance of smooth writing is also valuable to the engineer when he is interested in securing a higher paying job or one which would bring him closer to his home and family. In this instance, a well-written letter to a prospective employer might do the trick and land the job for him. On the other hand, if the letter is careless or not clearly written, it might ruin his chances for the job even though he is better suited for it than the next man.

7. The Technological Age brings increasing complexity in written literature. In order to understand the principles of abstract and diversified subjects, one must adjust his reading habits and attitudes to changing times and must add new words to his vocabulary.

The importance of reading technical magazines and reports is easily seen. But the reading of latest books and magazines, which contain fiction and non-fiction material, is very important in the engineer's social contacts. This non-technical material gives him the ability to speak to people socially. Reading material other than technical matter broadens an engineer's background and teaches him about other people, places, and ideas with which he does not have personal contact.

8. The art of communicating intelligently and correctly is one to be cultivated, for the engineer must be able to impart his ideas with dispatch and authority to both technical and non-technical personnel.

Few people possess the art of intelligent communication. The man who can guide others need not have the ability to do the job himself. A foreman does not have to be able to do the job "better than any man in the shop." He has only to guide, and guiding well demands not only a knowledge of the job at hand but the ability to impart his ideas with dispatch and authority and in language that will be completely understandable.

9. The speaking and writings of an engineer present a picture of the professional and social him.

Why is writing especially important for an engineering student? Regardless of the type of engineer that a person may be--electrical, mechanical, chemical--his writings, when read by people who do not know him personally, present a picture of the writer.

10. English inculcates the habit of good listening. . . "the final product of the master of good English."

Listening is the effect following the cause of speaking. The speaker can only present his case in the best way he knows, but it still remains that his audience must assimilate the material and evaluate it for digestion into its educational file. Usually good listening comes as a final product of the mastery of good English.

The Alumni

To two hundred alumni of the Classes of 1949, 1950, and 1951 Newark College of Engineering a questionnaire was sent to ask: What, in your opinion, is the position of English in the scientific and technological world of tomorrow? They reached the following conclusions buttressed by these quotations:

1. The knowledge of English is as important as the knowledge of technology.

> It is the most important subject we study. With the partial exception of mathematics, it is the means of expressing all other engineering arts and sciences in spoken or written form. Without perfecting the means of expression it is wasteful to perfect the art or science itself.

2. The knowledge of English is a necessity in the scientific and technological world.

> I feel that one of my greatest assets in the business world is to communicate clearly both in speaking and in writing so that misunderstanding is avoided. The need for this is and will continue to be of paramount importance. The teaching of this subject is not only desirable but necessary.

3. English will continue to remain as the primary mode of communication--not only in the scientific and technological world but also in the arts and political world. Without effective English there would be little hope for continuing progress.

> Since the magnitude of most scientific projects has been increasing in number of people engaged on one project and in scope, the problem of communication has become the limiting factor in many cases. English is our means of communication, and its use can determine the success or downfall of a project.

4. The knowledge of English will remain the common denominator for technical expression of and communication to all men.

> A. Technologists
> Communication between technologists is perhaps one of the most important phases of science. Unfortunately, too few engineers today can communicate adequately in writing because they lack brevity and a clear understanding of how to desribe their work. Reports and letters often omit important points.

B. Customer

Because of increased complexity in design requirements, it becomes important that every engineer know how to speak and to write effectively. In my own case I have found that in the vast majority of new projects I have engaged in, there was a direct contact between the customer and me, the salesman merely cited as the contact man.

C. Laymen

The study of English is very, very important. More and more engineer's writings and speeches are being directed to the layman. The layman must be given basis facts in simple but accurate form. Misunderstanding of scientific and technical information can be dangerous.

D. All levels of technology

The engineer must be able to express himself on all levels. This is so true in dealing with production help for fancy technical language is just a waste of time. As for the scientific world of tomorrow, if people cannot understand a sentence or idea, all the fancy technical wording will not explain a project.

5. English is gaining a more important place in the scientific and technological fields, and the ability to express oneself clearly and to put one's points across will determine to a large extent how far one can advance in these fields.

Extremely important--communication is the basis for judgment of abilities, in many cases. The well-written and the logical, well-delivered talk makes the man a success--all other things being equal.

6. All ideas and theories have to be expressed in words, written or spoken. To be understood, the language of the scientist or technician will have to be clear and accurate; hence, English should play a very important part in the training of future engineers, scientists, and technologists.

English is of the highest importance to convey clearly and precisely the tremendous impacts and accompanying changes which scientific achievements are making not only in everyday living but in the probable future adjustments to our moral and physical concepts.

7. The knowledge of English will maintain its present position of great importance as long as we and the British hold our technological co-leadership with Germany and Russia.

English will occupy a position of greater importance in the world of tomorrow. There are, however, two sides to this coin. On the one side, of course, is our rapid technological advance. On the other, however, seems to be our lessening of interest in other people and their languages while they are learning more of us and our language.

English is and will be the means of communication between technological persons and groups in English-speaking countries.

Alumni's Advice to Freshmen concerning the Study of English

Now, what can we as English instructors do to motivate our freshmen? For answers we should note what the alumni suggested. To the question--What advice would you give a freshman concerning the study of English in an engineering curriculum?--the alumni offered the following:

1. Approach English as you would any task. Work as hard at it as one needs to become proficient. English is governed by rules and laws as are all technical studies. Learn them and use them.
2. Utilize every opportunity to write; and in writing, practice conveying ideas clearly and concisely.
3. Treat English at least as importantly as any technical course and get as broad and comprehensive an English background as possible.
4. Become proficient in expressing yourself on paper. Develop the habit of writing all decisions, since industry tries to avoid verbal orders.
5. Learn the fundamentals of grammar well. Learn how to present ideas, to put important things first, and to eliminate the irrelevant and padding. Learn to write good letters and learn how to say "No" graciously. Secretaries appreciate a good letter writer who can say things speedily and effectively.
6. Learn to write technical papers and learn to read them. Learn how to organize and present a technical report verbally through use of charts, graphs, etc. And, above all, learn how to spell!

Misspelled words create about the same impression as gravy stains on a necktie.

7. Concentrate particularly in acquiring the ability to write clear, concise letters and articles. Master completely not only grammar forms but also rhetoric. Become thoroughly able to think and speak on your feet.

8. Treat English I as you would Physics I or Chem I. The pen displaces the slide rule as an individual advances in engineering.

9. Pay close attention to the assignments. Advance in business (including greater remuneration) can be achieved only by people who can express their thoughts and desires in a manner that will make them be listened to by others. This can be accomplished only by speech or composition.

10. Use your teacher harshly as your critic and work viciously at the job. It is a subject as important as any of the rest, and you cannot afford the luxury of letting the teacher set the pace.

11. Take English, but study communications. This, more than any other quality which you may possess, will set the rate and extent of your professional advancement.

12. Learn sentence structure and write intelligently. I think that the men should be made to read other men's compositions and reports to see how miserably most people write.

13. Do not consider English as a secondary subject. It can be more valuable than any technical course. The more responsibilities given to a person in his job usually means more administrative functions--resulting in less slide rule work and greater need for effective English to communicate ideas and policy.

14. If you do not succeed in mastering engineering, be certain to obtain a mastery of English. For in the end it will be the one subject you will need more than any other during your life time.

15. Learn to think and express yourself clearly, concisely, and convincingly, either in written or in oral form. Your ability will be judged by an expression in oral or written form. It is not sufficient to know the answer. You must be able to express it to others.

It is significant to note the following comments which the alumni made to the freshmen regarding their study of English.

> Although you may feel that this subject is not necessary now, you will find in later years that it is. Give it your attention and effort and you will find it worthwhile. Concentrate on developing an ability for expressing your thoughts and desires. Even if you know what you want, you will not be able to get others to do it unless you can communicate.

> I would urge him to look upon his English courses as a source of invaluable tools which will enable him to further his career as an engineer and citizen. Many engineers find that after graduation they do not lack the technical knowledge; they lack the "humanities."

> The engineering graduate of today who wishes to succeed must be capable of writing clear, concise, and, above all, brief reports and letters would almost relegate grammar and spelling to second place in importance. People in administrative capacities today just do not have the time to make out lengthy reports. The ability to dig out the meat of a report and put it down in one paragraph will often mean the difference between promotion and stagnation.

> I have found Report Writing to be the single most important subject learned in college. Shortcomings in any one technical subject can be overcome with Perry's or another such text. However, lack of writing ability shows up in the reporting of every project and can easily give a false impression of an engineer's ability.

The Role of the Humanities in the Engineering Curriculum

The Grinter Report[1] concerning the evaluation of engineering education focuses attention on the humanistic and social studies program in an engineering curriculum. Although the report stresses the aims of this program, it pays little attention to effective methods of presentation of the program. Obviously a solid humanities program is possible and feasible, as many respondents of various engineering institutions have indicated. To be successful, a humanities program should imbue its students with cultural ideal and an appreciation of values, should broaden the student's interests, and should teach the student the many meaningful approaches in which man can cope and deal with his world of reality.

A survey of engineering colleges[2] revealed that all accredited engineering curriculums are required to devote about twenty per cent of its time to humanistic and social science courses.

Aims of the Report

It is hoped that this report will give keener insights and a better understanding of the technical and scientific students; will challenge the English instructors to inspire and to motivate these students to achieve their maximum capacities in written and spoken communication and in their pursuit of the humanities; will present ideas for administrators and instructors to introduce new courses and to utilize various successful techniques of presentation of these courses; will offer the colleges the needs of industry concerning the writing of the speaking of their personnel. In addition, this report contains an enriched bibliography for instructors, students, and administrators.

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[1] Journal of Engineering Education. 46(September, 1955) 25-60.

[2] J.J.Ermene "The Convergence of Engineering and Liberal Arts Education." Journal of Engineering Education 50 (April, 1960) 262.

The Technical and Scientific Student

Dr. Kline Nall, Texas Technological College

Most students who are called "technical" or "scientific" on the basis of their interests in college or university work believe they are different from students in other fields. Many teachers believe they are. Statistics are agreeably pliable.

In 1953 Robert P. Weeks[1] found by questioning 100 entering freshmen engineers that the typical student bearing the engineering brand said that math or one of the physical sciences (in 87 of 100 cases) was his most liked subject, that languages (including English) was his least liked, and that English was his most difficult subject (44% said so).

At Texas Technological College, in 1963, in a group of 83 students in engineering and agriculture (considered as technical and scientific students; hereafter called t&s students, or even t&s's), 63 liked a physical science best, 51 liked math best, and, surprisingly, 7 liked English best (We may have several engineering freshmen who will become English-major sophomores). For every t&s who said English was his favorite subject, 7 said math was; for every 1 who gave English as favorite 9 listed a physical science. And 58 t&s's liked English least. Several liked both math and a physical science "best."

In a group of 79 Texas Tech arts and sciences freshmen (hereafter called a&s students, or even a&s's) questioned at the same time as the t&s's, 32 liked English best, 26 liked math best, and 25 liked one of the physical sciences best. Only 10 liked English least of all. With Tech t&s's math was a 7 to 1 favorite over English; with Tech a&s's math barely nosed out physical sciences for second place, holding 71% of the amount of popularity English enjoyed.

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[1] Robert P. Weeks, "A Statistical Profile of the Engineering Student" (mimeographed) College of Engineering, University of Michigan

Entrance examination scores shed some light on preferences for subjects. Weeks found that "In the quantitative section of the test(American Council on Education Psychological Examination in 1950) the engineers scored significantly higher than the literary freshmen, but the groups were not significantly different in the linguistic section." At Texas Technological College, the SAT scores of 80 freshmen engineers and 80 freshmen in Arts and Sciences (in each case, the first 80 names, alphabetized) showed only one point difference in the verbal score (474 to 473 in favor of the t&s's). On the math exam, however, the difference was appreciable (563 for engineers to 466 for a&s's).

Weeks found that most of his engineers came from the middle class, presumably on both social and economic bases. At Texas Tech students in both groups place themselves similarly, almost half the t&s's in the middle of the middle. (See Questionnaire, next page.) Most respondents naturally hesitate to claim high class, either socially or economically, and few will admit low class.

Weeks thought his literary college respondents were a cut higher than his t&s's in the social and economic scale. The trend may be demonstrable nationally, but available Tech statistics do not substantiate it. In Texas, agriculture majors may likely come from an economic bracket higher than that of the average a&s.

The following questionnaire was used in several classes at Tech in April, 1963. Agriculture and engineering students were designated as technical and scientific (t&s); Arts and Sciences students, the Business Administration students, and the two Home Economics students were called arts and sciences (a&s). Onto this questionnaire, insofar as it will fit, Weeks's information has been fitted.

Questionnaire
Weeks' 100 Weeks' 100

School: Agriculture 24 Arts & Sciences 65 Business Ad 12 Engineering 59 H.E. 2

From what social group do you come? high 6 a&s; 4 t&s middle 70 a&s; 79 t&s low 1a&s 1t&s

From what economic class do you come?
wealthy (parents having financial worth $250,000 or more) 3 a&s; 7 t&s
high middle class 19 a&s ; 23 t&s
middle of middle class 36 a&s ; 40 t&s
low middle class 11 a&s ; 14 t&s
low (parent or parents wage-earners; making less than $6000 together; renting home)
2 a&s ; 5 t&s

From what percentile of your graduating class do you come?
top 5% 17 a&s ; 14 t&s
top quartile 28 a&s ; 33 t&s
third quartile 19 a&s ; 25 t&s
second quartile 10 a&s ; 9 t&s
lowest quartile 1 a&s ; 2 t&s

In which of the following classes does your father belong? Check and specify.
Professional (law, ministry, medicine, teaching) 17 a&s ; 8 t&s
Weeks': 29 literary college; 18 engineering
Businessman 43 a&s ; 53 t&s Weeks' grouping put businessman and
Skilled laborer 12 a&s ; 23 t&s skilled laborer together: 76 in two
Unskilled laborer 2 a&s ; 5 t&s Weeks' 13 a&s; 5 t&s

In which of the following does your mother belong?
Housewife 50 a&s ; 63 t&s
Teacher 8 a&s ; 8 t&s
Businesswoman 11 a&s ; 10 t&s
Other 4 a&s ; 5 t&s

ducation of parents--indicate the year of education finished, or degrees earned
Father: Not high school graduate 12 a&s 26 a&s high school graduate 18 a&s 30 t&s
Weeks grouped a&s and t&s together: 66% finished high school mothers and fathers
Mother: Not high school graduate 10 a&s 20 t&s high school graduate 23 a&s 32 t&s
Father: Holds college degree 34 a&s ; 16 t&s ; Weeks': 50 a&s ; 33 t&s
Mother: Holds college degree 20 a&s ; 16 t&s ; Weeks': 47 a&s ; 11 t&s

ttitude toward courses in high school
English least liked 10 a&s; 38 t&s; most liked 32 a&s ; 7 t&s
Weeks showed 29 t&s who liked English least
Math least liked 35 a&s; 12 t&s; most liked 26 a&s ; 51 t&s
Weeks showed 87 t&s who liked math and or a physical science best

o you think there is a "typical" engineering student as distinguished from a "typical" nglish major? 22 a&s's said "No" ; 11 t&s's said "No"

Except as indicated in one place, all figures above are numbers, not percentages.

Weeks found that the 200 students whom he checked from the literary college of the University of Michigan were from better educated parents than the 100 t&s students he polled. "An analysis of the education of the parents indicates that the majority of engineering students have fathers and mothers who have at least a high school education (66%). One-third of all the fathers have graduated from college and one-tenth of all the mothers. The largest single group of fathers, however, (36%) have gone only to the common schools. This is in marked contrast to the literary college group of which the largest segment (50%) is made up of college graduates. It should be noted, too, that four times as many mothers of literary college students are college graduates as are mothers of engineering students (11% to 46%)." Nineteen sixty-three Texas Tech statistics show that one-third the t&s fathers and one-seventh the a&s fathers did not complete high school. Fewer than one-fifth the t&s fathers hold college degrees; more than two-fifths of the a&s fathers hold college degrees. Mothers of Tech t&s's have a mite more academic education than t&s fathers.

In Michigan ten years ago Weeks had the impression that t&s students were "quite a homogeneous group." Fathers of his t&s respondents were, in 76 of 100 cases, businessmen or skilled artisans. The 1963 Tech total for businessmen and skilled artisans was 76 or 83, or 81%. ("Businessmen" in Texas was defined to include farmers--many of whom are "windshield farmers.") More than twice as many Tech a&s fathers are in the professions as Tech t&s fathers. At this point I scream at my statistics.

In reply to the question, "Do you think there is a 'typical' engineering major?" 11 t&s's said no; 22 a&s's said no. Many respondents took opportunity to make statements about noticeable differences. On the whole, t&s's were much more dogmatic than a&s's about differences, real or supposed, between themselves and others. Comments varied from "The typical engineering student hates 'mickey mouse' courses more than the English major does--

else how could the English major major in English?" to "The only real difference is a difference in interests." Other representative comments are: "Engineering students carry slide rules on their belts; English majors look brainy and wear horn-rimmed glasses." "English majors seem to have no sense of humor." "The average English major is usually a little prissy." "Engineering students carry a slide rule and look healthier than English majors."

Herman Estrin questioned 200 engineering alumni of the classes of 1949, 1950, and 1951 on the books, magazines, newspapers they read, on the telecasts and movies they see and enjoy.[2] His respondents preferred westerns on television, they listed the Bible as their favorite book, they read their local newspaper (the Newark News), they read a professional magazine closely associated with their work. It would be interesting to compare responses from, for example, 200 New York City College school-of-business alumni, and 200 Texas Tech English-major alumni. The comparison has not been made. If it ever is made, it will likely reveal great similarities--I feel certain about the westerns--and no really significant differences. As Alistair Cooke insists in "Six Typical Americans," there are really no types--just "the variety and richness of God's creatures."

Not revealed from any questionnaire, but a firmly held opinion of this writer, is that the t&s student, if he can be typed, has a mental set best described as "practical," and a communicative purpose described as "informational." His interests are centered in the utilitarian rather than the philosophically theoretical and esthetic; his distinguishing trait is the desire to know about mechanisms, forces, stresses, processes--how things work and why they work; he is miscast unless he is especially interested in knowing, and in telling, how this or that works. He looks on language as a professional tool like chemistry, animal husbandry, or mathematics; he wants to write clearly, concisely, and logically, not because these are qualities most esthetically pleasing but because they get the communication job done best. He believes there is a technical communication quite different from literary communication--different in form and style because different in aim. His style, he believes, fits the task of dealing with the material. The literary style may do very well for abstractions.

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[2] Herman A. Estrin, "Engineering Alumni Cite Need of Training in English" The NCE Alumnus, Fall, 1958, pp. 7-8.

Ten years ago Weeks was worried because "seven times as many students majored in engineering as in English."[3] Nineteen fifty-nine - sixty totals show that 22,456 graduates received the baccalaureate degree in English and journalism in "aggregate United States (50 states, District of Columbia, and Puerto Rico)"; 37,808 received the baccalaureate degree in subjects labeled "engineering and applied science." According to Weeks, "In 1952 students who majored in the humanities received 17% of all bachelor's degrees conferred in the U. S., whereas nearly three times as many degrees were conferred on those majoring in the pure and applied sciences." The total for all beginning degrees conferred in the U. S. in 1959-60 in English and journalism, foreign languages, philosophy, and religion (all unquestionably humanities) is 40,422. The number of degrees in the humanities is nearly 62% of the total of 65,302 bachelor's degrees arrived at by adding the 37,808 in engineering and applied science, the 11,437 in mathematical subjects, and the 16,057 in physical sciences. The following chart[4] may allay fears that are a carry-over from ten years ago.

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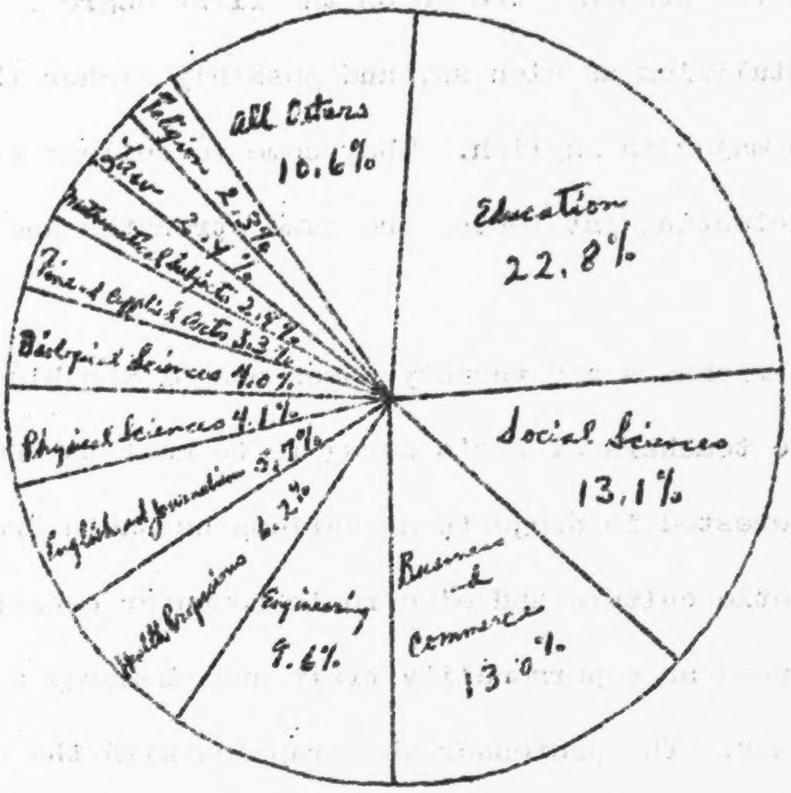
[3] Weeks quotes from Federal Security Administration, Office of Education, Earned Degrees Conferred by Higher Educational Institutions, 1951-1952, (Washington, Government Printing Office, 1952), pp. xvii-xviii.

[4] U. S. Department of Health, Education, and Welfare, Office of Education, Earned Degrees Conferred 1959-60, (Washington, United States Government Printing Office, 1962), p. 4.

Figure 2.--Percentage distribution of bachelor's and first-professional degrees conferred, by major area of study: 1959-60.



394,889 bachelor's and first-professional degrees conferred during the year.

In 1951-52, the year of Weeks' profile, Texas Tech had 349 Arts and Sciences graduates, 11 of whom were English majors; the college had 195 graduating with the B.S. in engineering fields. That year at Tech engineering graduates outnumbered English-major graduates nearly 18 to 1. In 1961-62 Tech had 748 Arts and Sciences graduates, of whom 50 were English majors; it had 246 getting the B.S. in engineering subjects, or nearly 15 to 1, engineers over English majors. Fears may still be in style at the College of Engineering in Michigan; they are at Texas Tech.

Who are the technical and scientific students? They are, nationally, about 10% of the students who go on the first degree. They are students who have mentalities as high as, and possibly higher than, those of students who major in English. They come to college with the same frivoliti the same fluctuating interests, the same strengths and weaknesses as other students.

The very richness and variety poses one of the biggest of the teacher's problems. We teachers of t&s's struggle to meet the English needs of students interested in subjects as various as Sabin Oral Vaccine and bridge building, beetle culture and electronic computer construction and operation, desire for speed as a personality trait and chemurgy adapted to the High Plains of Texas. The professor who grapples with the communication problems of these students will indeed feel that he wrestles not against flesh and blood but against the powers of the upper air. And American scientists and technologists are not usually good linguists. Science and technology abound with obstacles to the free exchange of knowledge between nations in their use of a multitude of technical terms and symbols. To help reduce these obstacles, and to increase the t&s's linguistic competency, is the task of the English teacher.

Kline A. Nall

Texas Technological College

Lubbock, Texas

April 23, 1963

The English Teacher of Technical and Scientific Students

Dr. Michael E. Adelstein, University of Kentucky

To obtain information about the qualifications and pedagogical views of English teachers of technical and scientific (T/S) students, the Committee on College English for the Technical Student mailed 215 questionnaires to the 159 institutions accredited by the Engineers' Council for Professional Development. Replies from 94 schools (60%) indicated that 19 or approximately one-fifth do not have any special English courses for technical or scientific students. To this number may be added many of the schools (40%) not responding if we assume that they ignored the questionnaire because they do not offer such courses and are not interested in the study.

Certain generalizations may be made on the basis of the 105 returned questionnaires:

1. A large number (51%) of teachers have majored or received degrees in fields other than English.
2. More than two-thirds (71%) have worked or taught in industry.
3. Only a few (9%) have ahd a course in technical or scientific writing as a student.
4. The teachers considered themselves qualified because of their experience (36%) and interest (31%), rather than education (22%).
5. On the basis of their reading and their membership in professional associations, the teachers are interested primarily in the broad field of English language and literature rather than the more specialized areas of technical communication and education.
6. Most (85%) believe that the English teacher of T/S students should be different in some respects from his department colleagues.
7. All agree that writing should be taught by an English teacher, although some (16%) stipulate that he should be specially qualified.

The Sample

Two hundred and fifty-one questionnaires were mailed to English department chairmen in the 159 institutions accredited by the Engineers' Council for Professional Development. Such a list is representative because it includes nearly all the state universities, several small private colleges (Antioch, Lehigh, Dartmouth), and some of the most famous private universities (Harvard, Yale, Princeton). Obviously, technological colleges such as Cal Tech and MIT were also among the group.

Sending the questionnaire to English department chairmen may have resulted in the failure to receive more replies from teachers in other departments. Excluding 10 teachers in Humanities and Social Studies, and 1 in Language and Social Studies, only 2 teachers were from departments other than English. We may assume, therefore, that the sampling is not completely valid since more than 2% of such courses as technical and report writing may be taught elsewhere. The margin of error here, however, is probably small.

The Teacher - A Profile

The teachers replying to the questionnaire were generally in the upper professorial ranks and have taught T/S students for many years. Among the 105 responding were 27 professors (25%), 35 associate professors (33%), 24 assistant professors (23%), 18 instructors (17%), and one registrar (1%). The average teacher has instructed T/S students for 13 years. Fourteen in the group have less than 3 years of experience while 22 have more than 20 years.

Of special interest in the teachers' education was that half have either majored or hold degrees in fields other than English. In order of frequency, the courses studied were mathematics, history, education, classical and modern languages, and the social sciences. The relative lack of interest in the physical, biological, and applied sciences is corroborated by the teachers having had little course work in these disciplines. Seventy-one completed only a minimum amount (1-3 courses); twenty-eight completed 5-7 courses; and six completed more than 8 courses. We may conclude, therefore, that although the English teacher of T/S students probably has a broader academic background than his department colleague, he usually has not had much more course work in the physical, biological, and applied sciences. In the absence of any recent and accurate profile of all English teachers, such comparisons are obviously not verifiable and are presented with that qualification.

Also subject to such a qualification is the conclusion that the English teacher of T/S students does not hold as high a degree as his department colleagues. Despite their predominance in the upper professorial ranks and their many years of teaching experience, less than half of the teachers replying to the questionnaire have a Ph.D. (44) or Ed.D. (3) while the majority (58) hold lesser degrees.

Especially noteworthy about the teachers was that more than two-thirds have worked in industry. Of these, 64% have served as editors, writers, or consultants; 20% have performed various skilled and semiskilled jobs; and 16% have taught.

In contrast with the many employed in various writing positions are the few (9%) who have had courses in technical or scientific writing. We may assume that more have not completed such courses because they were not offered years ago; or if they were, they were available only to engineering students. In addition, while one would expect a Chaucerian scholar to have studied in his field, few would require the technical writing teacher to have done the same.

Professional Interests

Thirty-nine of the 105 teachers replying are currently engaged in some form of research activity. Seventeen are writing or revising textbooks; ten are examining scientific writing; four are occupied in linguistic studies; three are analyzing rhetorical techniques; one is concerned with the history of science; and one is investigating industrial needs.

Among the periodicals and professional journals, COLLEGE ENGLISH was the most popular with a total of 46 regular readers. Other favorites ranked in the following order; PMLA-41; ASEE JOURNAL-26; AAUP BULLETIN-19; STWP REVIEW, CCCC, and SCIENTIFIC AMERICAN-each 18; and the SATURDAY REVIEW, ABWA BULLETIN, and CEA CRITIC with 9 each. Thirty teachers (29%) indicated that they did not regularly read a publication mainly devoted to communication, scientific or technical education, or science.

As one might expect from the results about the reading selections, NCTE was the professional organization with the largest membership, 38. Next in order were MLA with 34, AAUP with 32, ASEE with 24, STWP with 21, CCCC with 19, ABWA with 12, and CEA with 10. Slightly less than half the group (44%) did not belong to a professional organization mainly concerned with technical or scientific research, with the education of T/S students, or with communication skills.

Among the replies were numerous suggestions for worthwhile extracurricular activities, although some indignantly stated there was no time for anything extra. The most widely supported recommendation was that teachers should read scientific publications and books. In addition, twelve individuals proposed participating in professional associations, six mentioned working as consultants in industry, five named developing hobbies in technical fields, and another five advised assisting with student publications. Other recommendations included working as an editor, socializing with people from industry, reading science fiction, participating in dramatic productions, visiting industrial plants, joining or coaching debate teams, and becoming active in student organizations.

Pedagogical Attitudes

Experience was the factor selected by most teachers to indicate why they felt particularly qualified to teach T/S students. Because 71% of the group had worked in industry, it was not unexpected that such service would be valued. What was somewhat surprising was the selection of interest as the second most important factor. Nearly half of those replying (47%) felt especially suited to teach T/S students because of their interest both in the student and his problems. Other factors noted were education (33%), personality (11%), and necessity (4%). In commenting, several teachers wrote that they had originally been forced into their teaching assignment but now found it challenging and stimulating.

In departments and schools not solely comprised of T/S students, the largest number of teachers (43%) noted that their English department colleagues generally considered the T/S student teaching assignment to be dull. Colleagues were thought to view such assignments as stimulating in 7% of the replies, as routine in 33%, and as incompatible in 17%.

As for the placement of T/S students in freshman English sections, the overwhelming majority (93%) favored heterogeneous grouping while only a few (7%) advocated separate classes.

Such a one-sided response was surprising because of the widely held view that the English teacher of T/S students should be different in some respects from his colleagues. Since 85% of the replies expressed this attitude, one might not expect to find that 93% would place the T/S student in regular freshman English sections with regular English teachers. Many may have had the advanced T/S classes in mind when suggesting that they be taught by someone with special qualifications and interests. Others may have envisioned the administrative difficulty of providing separate sections with appropriate instructors. Yet there seems to be an area of contradiction in the thinking of those who believe that the T/S student responds best to certain motivations, techniques, and curricula, but who would still subject the student to the traditional freshman course taught by the traditionally-minded teacher and concerned with traditional materials. This problem, of course, pertains to the universities rather than to the technological colleges.

In discussing precisely how the teacher of T/S students should differ, 36 (40%) indicated that he should be interested in scientific developments and in technical writing. Twenty (22%) felt that the teacher should have had some experience in industry, and fourteen (16%) stressed the importance of the teacher's being tolerant, sympathetic, and respectful of the student's interests and special aptitudes. According to several replies, the instructor must realize that his students are not English majors, that they are not vitally interested in English, and that they are frequently brilliant and gifted in their own fields.

Some 15% of the replies dealing with distinguishing characteristics mentioned that the teacher should have a scientific background, an understanding of technical vocabularies, and a scientific bent. A similar number of questionnaires singled out the importance of the teacher's insisting upon functional rather than aesthetic aspects of communication. Among other singular characteristics was the mention of personality. Writers stated that the teacher should not be "arty," "prissy," "ivory-towerish," "long-hair," or "pantywaist"; instead he should be "manly."

Of the sixteen (15%) who saw no need for the English teacher's being different, one wrote that it is "false and pernicious to assume that the writing of technical English is different than the writing of English."

As for who should teach writing, everyone suggested that it should be taught by the English teacher. Fifteen stated, however, that the teacher should have industrial experience or a knowledge of technical subjects, while two advocated dividing the writing course with a teacher from a technical field.

CONCLUSIONS

The English teacher of T/S students has not had as much academic education as his colleagues but he has had more experience outside the university community and he has broader interests. Judging from his reading and from his membership in professional associations, he is still interested in literary scholarship and still considers himself in the traditional role of an English teacher. Despite this interest and conception, he is not engaged in literary scholarship and to a great extent, is not as research-minded as his English colleagues. Probably one of his difficulties results from his singular role: he is neither highly regarded by his colleagues in his own department nor by those in others. He is generally looked down upon as a teacher of a service course rather than of an intellectual discipline. He has no professional organization specifically concerned with his problems although NCTE, STWP, ASEE, and ABWA have all indicated varying degrees of interest. Industry, however, gives him the respect and recognition he craves; in addition, it pays him well. These enticements from outside the academic community may seriously deplete the ranks of the English teacher of T/S students by creating a greater demand for specialists in communication skills, especially those with knowledge of and experience in scientific and technical fields.

If he remains within the academic ranks, the English teacher may continue to be idle and unappreciated, or he may strive for greater recognition for himself and his field. He may become more active in professional organizations. He may master and utilize many of the new linguistical techniques. He may investigate and test different methods of communication. But perhaps more than anything else, he might be helpful in improving the general teaching of English.

Since the non-English major is the primary concern of most English departments, the teacher of T/S students is in a unique position. He has learned how to communicate to non-English majors and how to teach these students effectively. In the three areas of English--writing, language, and literature--this teacher has a particular approach and a special contribution to offer.

In teaching writing, he has learned how to make students more aware of the importance of mechanics, the value of conciseness, and the significance of tone. To some extent students do consider these matters in freshman English courses but seldom are they sufficiently stressed.

In their future roles as business men and women, parents, neighbors, and voters, and as members of social, church, citizen, business, school, and fraternal groups, students will have to write hundreds of letters, memoranda, reports, invitations, statements, requests, releases, and inquiries. At such time, their inadequacies will come to light as they struggle for clarity and precision. They may wish on these occasions that they had concentrated more on learning how to write. What they may not realize is that they were probably poorly motivated by teachers interested in grace and elegance rather than simplicity and effectiveness.

Too often freshman English is taught in an intellectual vacuum. The student is told that writing is important because it is important to write, or because it is the sign of a cultured person. When he comes in contact with a T/S teacher, however, he realizes that of all the knowledge and skills he may acquire in college, writing is one of the most valuable. Such a teacher has probably taught night courses to businessmen, served as a consultant in industry, or instructed at workshops. From these experiences he has perceived the importance of writing and has realized how most people regret not having worked harder in their college English courses.

In addition to better motivating students, the T/S teacher is able to emphasize certain aspects of writing that are often neglected. The common complaint about colleges is that they fail to teach students how to write. When interrogated closely, the critics generally disclose that they are referring to spelling. College instructors usually consider this subject to be a high school matter or else they attend to it by lowering theme grades without offering constructive comment. The T/S instructor may not have the time to deal with spelling but realizing its practical importance, he can instill in students the value of their checking all doubtful words in the dictionary. By acquiring this dictionary habit, students can avoid the embarrassment or serious consequences resulting from misspellings in a letter of application or a business report.

Conciseness is also a desirable writing goal that can be skillfully imparted by the T/S teacher. During the student's high school days and even in freshman English, he has learned to pad effectively to reach the required number of words assigned for a theme. Penciled computations in margins often indicate his efforts. These verbose habits are corrected by the T/S teacher, who realizes what short, crisp statements are favored in business and industry, as in other fields. Most people would rather read a two page report than a three page one. Consequently the T/S teacher spends much of his time getting students to eliminate unnecessary "which's," "who's," "ion" words, and "of's," and to change wordy verb-noun combinations like "to give consideration" into "to consider." Under the eyes of the T/S teacher, pruning rather than padding is the rule.

Another aspect of writing usually neglected in freshman English courses is tone. Students write for their teachers rather than for a particular audience. The goal is a somber, formal, emasculated style that is ineffective in many situations outside the classroom. T/S teachers usually assign problems in which the audience and the occasion are clearly specified. Instead of writing a theme about integration, the T/S student might be asked to draft a letter for mailing to fraternity alumni about a chapter's intention to pledge a Negro member. Or, instead of writing a paper on recent or future developments in his major field, a T/S student would be required to prepare a statement for a high school newspaper about his main field of interest so as to attract high school students. As a result of such practice, the college student learns how to write to different people under different circumstances. Such flexibility is highly desirable.

As a general rule, the T/S teacher deals with style to a greater extent than his English colleagues. In most freshman English courses, for example, content outweighs form in grading. A student with some specific information about a subject, or one who has acquired insights through better high school preparation and family experiences may bring much impressive knowledge to a given theme assignment. He may know more about the criteria for evaluating movies, the causes of juvenile delinquency, the state of college athletics, the issue of prayer in the public schools, or the arguments for and against euthanasia. The T/S teacher reduces such background advantages by assigning subjects that place all students on a more equal footing and stress writing skills rather than political, psychological, sociological, or historical acumen. The average freshman, for example, is told to write a paper on a given subject even though he may be uninterested and uninformed about it. In grading these writing assignments, the traditional English teacher often stresses ideas, supporting details, and completeness or information at the expense of style. The T/S teacher deals more fully with "pure" writing and is generally more willing to overlook content deficiencies. Certainly some of this greater emphasis on stylistics could be incorporated into freshman and other writing courses.

The T/S teacher could also make his influence felt in the teaching of literature. Too often poetry in particular is an anathema to non-English majors because it is dished up as pretty, precious, sentimental, and full of imaginative flights. That poetry need not appeal only to delicate souls and need not be solely concerned with love, nature, and beauty comes as a surprise to many students. They may be brought to enjoy Hopkins, Yeats, Eliot, and Pound but only after they have grown to appreciate Frost, Housman, Hardy and Whitman. They need to be allowed to subordinate the subtleties of versification and to concentrate on the way that language works in a poem. For it is an understanding and appreciation of language that will mainly enable students to understand how poetry differs from prose, and why poetry continues to delight and stimulate mankind.

The teaching of other genres could also benefit from the experience of the T/S teacher. That English teachers are generally ineffective can be observed in the national disregard for fine books and serious periodicals. Part of this deficiency may derive from the classroom tendency to explicate a work to pieces in stressing the aesthetic approach. The T/S teacher has found that students respond best in considering literature from the humanistic viewpoint. Although interested in education so that they may earn a living, T/S students are deeply concerned about what kind of life this living should provide. Literature reveals to them the nature of their fellow man, who shares some of their own feelings, passions, fears, desires, and ideals. Literature also portrays the universe with its forces and powers that influence and shape their lives. From literature the student may mature and grow to gain in perspective and insight as he becomes intellectually involved in his readings. In this process he may wish to discover how literature works with its use of myth, paradox, symbol, and ambiguity. To commence with such matters, however, is to assume that the student enjoys, understands, and appreciates literature. Such assumptions are often unfounded as the T/S teacher has learned from working with his students.

Finally, the T/S teacher can also share his techniques of making students more aware of the growth and development of language. This concern for the way in which language functions should not only make the student more aware of the rationale behind Webster's Third but should make him sensitive to words, and excited about their behavior. To the English major, the study of language is a tool that he may use in understanding literature or in teaching composition. To the non-English major, the study is not obviously functional or intrinsically fascinating. When he realizes, however, that it is related to his world and his work, then he may develop an acute sensitivity to language and its use. He will, for example, be interested in such acronyms as "radar" and "laser" for they are used frequently. He will be amused at the extention of words, such as "transistor," which has broadened from representing a miniature electronic device to signifying a small portable radio powered by such devices. The clipping of "monaural" to "mono" and "stereophonic" to "stereo", the use of "retrofire" instead of the cumbersome verb-noun phrase, and the formations of "bathynaut," "medicare," and "overflights" will all alert him to the ways that language is rapidly changing to meet our needs. Students particularly enjoy coining words to fit future situations or devices that may develop within their own fields.

As a result of the experience accumulated in working with non-English majors, T/S teachers can be helpful in suggesting techniques and approaches that would be effective in freshman English and in other English courses taken by many non-English majors. The teaching of English cannot be measured solely by the attainments of English majors, but must be gauged also by the achievements of the masses of non-majors who pass through English classes. In dealing with such students, the T/S teacher could be invaluable to his colleagues in suggesting methods, approaches, and techniques to awaken interest, stimulate discussion, and engendor learning.

A SURVEY OF THE TEACHING OF ENGLISH TO ENGINEERING AND SCIENCE STUDENTS

Dr. Herman A. Estrin, Newark College of Engineering

How are scientific and engineering students taught College English? What are the objectives of these courses? Are there special courses in English especially for these students? What is the rationale of these courses? What are the textbooks used in these courses? What are the effective methods of presentation? How are students grouped? How have the humanities been increased in the curriculum? How can one improve his teaching of English? What about the five or six-year program for engineers?

These questions were asked in a survey sent out to sixty colleges and universities which were on the approved list of the Engineers' Council of Professional Development. Fifty-five institutions replied to the Committee on College English for the Scientific and Technical Student, National Council of the Teachers of English.

Sixty per cent of the respondents have a special course in English designed for scientific and technical students. The most popular titles of these courses were the following (in descending order):

Technical Writing
Report Writing
English Composition or Technical Composition
Expository Writing or Exposition for Technical Students
Engineering Reports

Scientific and technical students who do not take these above courses study the following:

English Composition
Composition and Literature
Communications and Communication Skills
Literature (Masterpieces of American, English,
and World Literature)

When asked whether the Department had a written course of study, fifty-five per cent of the respondents sent a syllabus.

In summary the aims and objectives of these courses of study are as follows:

1. To broaden the students' reading background and deepen their appreciation of the enduring ideas, themes, and values in literature--English, European, and American.
2. To help students become more perceptive and discriminating in literary taste.
3. To convey through the study of literature insight into human experience.
4. To stimulate students to exercise the cultivated sensibilities and the insights that humanize the activities of living and that bring acceptable ethical standards for human conduct.
5. To help students express their ideas in exact English prose.
6. To guide the student so that he may achieve self-understanding and self-discipline.
7. To foster lifetime reading plans and habits.
8. To replace language inexperience and apathy with conscious, durable skill in communications.
9. To introduce the student to the human experience that books contain and to help him see its relevance to his own experience in life.
10. To give the student an understanding of the basic processes of language and a review of the language--its history, development, structure, grammar, and correct and effective use.

The Rationale for Teaching

The rationale for the teaching of courses with the above aims are stated in the following single-spaced paragraphs which the respondents wrote:

> We want to give scientific and technically inclined students an understanding of humanistic approaches to life.

> The courses in English aim to teach the student to use English correctly and effectively in written and oral communication, to give him a basic knowledge of the content and form of technical reports, and to introduce him to various cultures through literature; other departmental courses aim to give the student a background for

understanding current political problems, national and international, and for appreciating the physical environment in which civilization has developed and by which is influenced.

Writing and speaking skills are fundamental tools for getting society's business done: without them the professional man, whatever his experience or knowledge, is restricted in professional and civic influence. The language course offers a proved technique for learning a skill: constant and regular practice supervised by an expert.

Sutdy of creative literature humanizes the student in significant and lasting ways--a process particularly important for technical and scientific students, who are inevitably moving towards leadership in our highly organized, technologically oriented society. The literature course, with its intensive and dramatic discussion of human experience past and present, extends the student's limited understanding of the values, behavior, and qualities of man and hence helps create leadership potentiality.

Guided by recent studies made possible by the leading foundations, the Engineering and Business schools have included as many liberal arts courses as particular fields of study can allow in a degree program.

Rationale for sophomore genre courses in the readings in modern literature emphasizes man's search for knowledge, self-understanding, and values. These sophomore genre courses may not be elected by departmental majors.

The purpose of education in every area is to teach our designated goals, but English courses are particularly effective in achieving these goals through the broad access that literature provides.

Average Class Periods and Class Size

As for the number of class periods per week allotted to the course, sixty-five per cent of the respondents met three times a week for two semesters; ten per cent, twice a week. Eighty-five per cent stated that the class periods are fifty minutes long, but several were ninety minutes. The average class size in twenty-five students, although the range of number of students in the class is from eight to forty. Respondents recommended that classes must be small. A typical class would have twenty students.

Most classes are grouped by technical interests; others, by test scores. Several colleges have no special grouping because of the problem of scheduling. Other means of grouping are (1) alphabetically by interest groups, (2) by honor sections.

TEXTBOOKS

Textbooks Used in Various Freshman Courses (Each list of books is used in one course.)

Applied Logic	Little, Wilson & Moore
Studies in Prose Writing	Kreuzer & Cogan
Writing With a Purpose	James M. McCrimmon
American Poetry and Prose (4th complete ed.)	Norman Foerster

Language and Literature	Brown & Olmstead
Short Fiction	Frakes & Traschen
Prose Readings	Sale
Immortal Poems	Williams
The Iliad	
Greek Tragedies Vol. 1	
The Canterbury Tales	
An Introduction to Shakespeare	
Faust	
Madame Bovary	
Darkness at Noon; Plus four to six other selections at the discretion of individual instructor	

Thought in Prose	Beal and Korg
Modern Rhetoric	Brooks and Warren Harcourt
Handbook for Writers	Leggett, et al
John Brown's Body	Benet
Adventures of Huckleberry Finn	Clemens
Billy Budd and Typee	Melville
Red Badge of Courage	Crane
Harbrace College Handbook	Hodges
The Story of English	Mario Pei
The College Experience	Bellman
Cross Currents	Simonsen
F. L. Allen's 3 books on American History	
The Good Years	Lord
Language and Literature	Brown and Olmsted

Rhetoric Reader	Talmadge et al.
Student and Society	Clark and Culler
Discourse of Reason	Sherwood
Literary Types and Themes	McNamee et al.

Harbrace College Handbook
Harbrace Collegr Reader (Two non-fiction books selected by teacher)
Trio
Choice of two paperback books from the following titles:
The Return of the Native, The Adventures of Huckleberry Finn, Othello, and Look Homeward, Angel.

Writer's Guide	Perrin
Essays	Guth
Of Human Bondage	Maugham
The Scarlet Letter	Hawthorne
What Is the Short Story?	Garcia-Patrick
Form and Style in Thesis Writing	Campbell

Textbooks Used in Various Sophomore Courses

The Illiad	Homer
Candide	Voltaire
Pride and Prejudice	Austen
Lord Jim	Austen
Fathers and Sons	Turgenev
The Great Gatsby	Fitzgerald
Story and Structure	Lawrence Perrine
Discovering Modern Poetry	Elizabeth Drewnd George Connor
Contemporary Drama, II Plays	Watson & Pressey

(This is a one-semester course called Reading for Discovery)

Seven paperback books with the following titles:

- Oedipus the King and Antigone
- The Canterbury Tales
- Hamlet
- Paradise Lost
- Gulliver's Travels
- Man and Superman
- A Farewell to Arms

Ten Modern Masters	Davis
Short Novels of the Masters	Neider
A Glossary of Literary Terms	Norton & Rushton

Conrad's Heart of Darkness and the Critics	Harkness
Understanding Poetry	Brook & Warren
The Poems of Robert Frost	Frost
A Farewell to Arms	Hemingway
Look Homeward, Angel	Wolfe
Four Modern Plays	Ibsen, Shaw, O'Neill, and Miller
Saint Joan	Shaw

Darkness at Noon	Arthur Koestler
Great Traditions in Ethics	Albert, Denise & Peterfreund (eds)
The Pursuit of Learning	Nathan Starr (ed)
The Complete Plays and Poems of William Shakespeare	Neilson & Hill (ed)
Thinking Straight (paperback)	Monroe C. Beardsley
Atlantic Magazine (Oct., Nov., & Dec. 1962)	

The Canterbury Tales	Chaucer, Geoffrey
Five Plays: Hamlet, King Lear, Henry IV (Part 1), Much Ado About Nothing, The Tempest	Downer, Alan S. (ed)
Paradise Lost	Hughes, Merritt Y. (ed) 1962 Edition
Joseph Andrews and Shamela	Fielding, Henry
Coleridge	Coleridge
Wuthering Heights	Bronte, Emily
Three Short Novels: Heart of Darkness, Youth, Typhoon	Conrad, Joseph

Textbooks in Various Elective Courses

Early English Masterpieces:

Mediaeval Romances	Loomis
An Anthology of Old English Poetry	C. W. Kennedy
C. T. and Troilus and Criseyde	Chaucer
Song of Roland	

A one-semester course called Major American Writers. Four books with the following titles:

Selected Prose and Poetry	Emerson
Walden; On the Duty of Civil Disobedience	Thoreau
Moby Dick	Melville
Leaves of Grass & Selected Poems	Whitman

Speech Communication	Brigance
Modern Technical & Industrial Reports	Comer & Spillman
Toward Better Vocabulary	Mullen

Modern Verse in English	Cecil & Tate
A Portrait of the Artist as a Young Man	Joyce
Sons & Lovers	Lawrence
Light in August	Faulkner
Hedda Gabbler	Ibsen
Death of a Salesman	Miller
Look Back in Anger	Osborne
The Stranger	Camus
The Complete Poems & Plays	Eliot
Lord Jim	Conrad

Technical Report Writing	Schultz & Webster
Clear Writing	Kirschbaum
Pro & Con	Matlaw & Stronks

Value & Obligation	Brandt
Introduction to Logic	Copi
Perspectives in Philosophy	Beck
The Structure of Scientific Thought	Madden

Selected Poems of John Donne	Donne
Paradise Lost & Other Poems	Milton
The Poetry of Pope; A Selection	Pope
Moby Dick	Melville
The Scarlet Letter	Hawthorne
Madame Bovary	Flaubert
The Mayor of Casterbridge	Hardy
Crime and Punishment	Dostoyevsky

Introducing Shakespeare (paperback)	G. B. Harrison
The Complete Plays and Poems of William Shakespeare	Neilson & Hill (eds)

The Increase in the Humanities

Throughout the courses of study it was noted that the humanities have been increased in the curriculum in the following ways:

1. All engineering school students are required to carry one course in a humanistic/social field each semester. This is an addition to 10 required hours in English and in Speech.

2. Over the years there has been a gradual increase to the point at which the humanities now comprise approximately 40% of the required curriculum.

3. Two years ago, a Language Arts major was introduced (an "early" English major had been eliminated some time before this) and a number of advanced genre and historical survey courses were added to the curriculum, as were courses like "The Bible as Literature".

4. In recent years these courses have been codified so that there are definite requirements and some electives from an approved list. The result has been a requirement of approximately 20% of total requirement, and probably a slight overall increase over requirements before such codification.

5. What little gains have been made have come 1) through pressure from national professional technical and scientific societies (American Society for Engineering Education, etc.), which are usually more liberal than directors of instruction of the local technical schools, and 2) through patient, forceful, and usually lonely argument by individual members of the department confronted by skeptical colleagues and administrators in the technical schools.

6. Introduction of Literature was placed into the third quarter of the Freshman composition course.

7. Students enrolled in the Schools of Engineering and Mines may elect courses in the humanities up to a limit of twenty credits.

8. All juniors and seniors may take elective courses in the Humanities. These electives in the Humanities include courses in music, art, history, literature, philosophy, and psychology.

9. When the Academy began in 1955, the only English courses available were given in a prescribed eighteen-hour sequence. We now still have the prescribed sequence; in addition, we have nine enrichment courses, enrolling over 200 cadets per semester, or approximately 10% of the student body.

Effective Methods of Presentation

As for effective methods of presentation that have been used, the respondents answered: (The single-spaced paragraphs are the exact words of the respondents)

1. A Practical Approach--"Writing, writing, writing!"

The course concentrates on writing; effective reading is implicit in the preparation of the three research papers required for the course. The students' papers are read by an adviser in his field; in this way the technical composition instructor is free to direct his attention to organization, form, and style.

These courses are, as much as I can make them, laboratory courses. The writing course (class) is completely taken up with learning a techniques of writing a technical report, a technical article, and a critical review of a published technical article. A great deal of attention is given to supervised editing.

Principally writing: reports of various sorts, the terminal paper something in the nature of an article. Oral performance is included--it may be an oral report, or (lately) turning the class into a committee meeting.

Writing, correcting writing, and more writing and analysis of problems of report writing--none of these are special, but emphasis on organization of facts is stressed. One full-scale investigation report is assigned at end of semester, preferably from non-library material.

2. The Case Method.

In the use of case method the class analyzes and discusses various reports. The process, it should be emphasized, is developmental (i.e. reports are studied with relation to underlying fundamentals of communication).

3. The Oregon Plan.

By using the Oregon Plan, students in groups of four evaluate one another's papers. The group discusses all points, and each member writes a critiques of the papers he has read.

4. The Use of Audio-Visual Aids.

Slides, flims, film strips, and other visual aids attempt to strengthen the students' interest in literature. Our Student Union works closely with us by bringing films of the classics to our campus.

For several years this department has made effective use of projectual devices in the teaching of grammar and composition. We have found that the use of radio and television and exhibits and displays, have immeasurably improved the effectiveness of presentation.

5. The Greater Use of Paperbacks.

Some new interests have been engendered by introducing, usually through the use of paperbacks, more literature into the sophomore writing courses.

6. Experiments in Team-Teaching and Programmed Instruction.

Experiments in team teaching, programmed instruction, or language labs are taking place. It is not easy to pick on any one technique that is bearing fruit.

7. The Use of Excellent Teachers.

We assign instructors of proved merit to teach the technical and scientifically inclined students.

8. The use of Student's own experience as a source for themes.

In the freshman writing program we have moved away from the book of readings approach and have concentrated more on the student's own experience as a source for themes. At least one period in three is set aside for discussion of student writing. At this period we often have a cadet theme mimeographed and passed around to the entire section of which the cadet is a member. Everyone (including the writer) spends fifteen minutes or so grading the theme (the writer is, of course, not identified). Everyone learns from the experience, but especially the writer. Students are never too concerned when an instructor tells them they are obtuse or confused, but when a jury of their peers independently arrives at the same conclusion, it shakes them. We also collect the best cadet writing into little magazines. This serves as a stimulus to the better writers and provides us with good models for classroom discussion.

9. The approach to literature as a record of human experience.

In the matter of literature, the general approach is to treat literature as a record of human experience and to use it as a humanizing influence for people who tend to think too much in terms of things, not human beings. This means we do not deal overmuch with such English-major concerns as genre, poetic form, etc. My own greatest concern is always to make literature a pleasurable experience. If I do this, then the student, no matter where his career ultimately leads him, may become one of Dr. Johnson's "common readers."

10. The use of Scientific American in technical writing classes.

Our technical writing students, who are engineering majors, recieve semester subscriptions to Scientific American and are assigned articles for reading and study. We find that the usually well-written articles are excellent teaching aids for graphic presentation, caption usage, and, of course, scientific writing for the educated layman. The engineering student is able to leave his narrow specialized field and discover other areas of scientific inquiry which may be of possible use to him.

Suggestions for the Improvement of the Teaching of English

To the question for other English instructors of engineering and science students what machinery might be set at work to foster their improvement of the teaching of English? The respondents answered:

1. Allow the technical writing courses to be taught by men with experience in writing for government and industry.

2. Suggest that instructors read College English and Journal of CCCC, as well as other periodicals; get them to participate in professional organizational meetings; institute summer work shop programs. Try to promote greater interest through each department chairman.

3. Insist upon good, correct writing and careful checking of all written work from this point of view; send students to English instructors if they reveal deficiencies after the freshman year; establish an examination plan whereby students would not be graduated if they did not satisfy the English department as to their competency in the language.

4. Require a professional doctor's program for higher education.

5. Emphasize more and more that engineers are human beings and will benefit from liberal education just as much as Arts and Science majors.

6. Have the instructors of engineering and science students to obtain an understanding of the aims of such students. Encourage the instructors to read some of the literature in engineering and science and to become acquainted with the basic terminology. Read The Journal of Engineering Education, Daedalus, The American Scientist, Scientific American, among others.

7. Improve the quality and background preparation of teaching personnel.

8. Encourage joint meetings of English teachers and science teachers at the meetings of such established societies as NCTE and The American Society for Engineering Education.

9. Employ that English instructor of engineering and science students who shows some sympathetic understanding of scientific problems, endeavors, and methods. He does not have to have a science minor; but he should read, at the least, some of the many popularized scientific articles in our magazines and periodicals.

10. Reaffirm to the instructor this obvious fact: that the teaching of language and literature to technical students is about as close to the unique problems and challenges of 20th century America as any English instructor can get. Any "machinery" that argues to the instructor that society--at least academic society--agrees with this proposition and its implications. Such argument might be communicated in terms of government or industry

support for graduate and post-doctoral study, sabbaticals, salary supplements, distinguished professorships, and secretarial help.

The Need to Change the Character of Undergraduate Programs

"....increasingly engineers are moving toward five and six years of study. This is a definite extension, and it carries with it the need to change the character of the undergraduate programs." The respondents commented on this quotation as it pertains to their curriculums. An extension to five or six years offers a real opportunity for preprofessional education equivalent to that in medicine and law. Under the present four-year program neither professional training nor education is adequate.

Our engineering curriculums are extremely tight, each one having a complex flowsheet pattern of courses, with almost no margin for electives. In practice many engineering students stay in school a little longer than their flowsheet calls for, so that they can pick up some more electives. How long the four or five year engineering curriculum can remain as tightly compartmentalized as it is, is hard to predict.

This trend suggests that we will want to campaign for wider engineering participation in the humanities program--continuing our attempts to convince the engineering school that language skills courses are no substitute for literature courses specifically designed for the humanizing process.

This trend is one which basically this department is in favor of but to which the college administration seems clearly to be opposed. Any extension of the period of study is on the graduate level, and this level does not concern this department except for supervision of theses.

Our curriculum will soon be a five-year program. This program will allow engineering students to elect a greater number of courses in the humanities than they have been able to in the past.

This certainly does apply to us. Through several methods--the enrichment program, college transfer credits, validation of courses--many of our students attain what is almost the equivalent of a Master's degree. Starting this year, many of these students will attend a civilian school for six months immediately following graduation. By transferring some of their Academy credits, they can obtain a Master's degree either in a science field or in internation relations.

A Positive Approach to Teaching of English to Scientific and Technical Students

In view of the latest trends in the teaching of English, how can we direct our colleagues to undertake a positive approach and to do something about the teaching of English to engineering and science students? To this question the respondents stated:

1. Get the instructors themselves to have some humility toward what the scientist and the engineer are doing. Most English teachers need to have sympathy with the aims of such different disciplines. Many of the English teachers we get are almost totally ignorant of science and engineering.

2. Have more academic meetings of an organizational character, at which outstanding figures will participate; work through each department chairman to promote greater interest.

3. Acquaint them with the demand for literate scientists and engineers

4. Employ qualified, full-time men and use not only junior but senior members of the department for lower-level teaching of technical students. We hope that we are "doing something" about the teaching of English to engineering and science students.

5. Teachers must remember that teaching the technical student is not a process somehow removed from that of teaching the Arts and Science student and that they must keep this idea always in view.

6. Many technical students will go on to become important men of affairs, men important in industry and government. Realizing this fact and realizing the importance of the humanities in the full development of this student into a man should provide an instructor of technical students with sufficient motivation to teach literature and to teach it well. He should remember always that he isn't teaching pat solutions (not even pat interpretations of works read) but rather a way of thinking in which human values are given their due weight.

7. The English teacher must be sincerely interested in science. (There are many English teachers who have scientific backgrounds.) This is not too much to expect. Any twentieth-century man should be concerned with space travel, underwater exploration, medical research, and the awful weapons of annihilation. We should have more social and professional contact with our scientific and engineering colleagues, who are usually willing and happy to explain any of their projects. (And, I may add, they will probably seek your assistance in solving any writing problems they may have.) Our scientific colleagues are not ogres; they are, as a rule, as charming and pleasant as we think we are.

Industry's Need

Professor Grady Stubbs, General Motors Institute

The problem of how to relate the teaching of college English to industry's need was approached by members of the Committee on College English for the Technical and Scientific Student in the following ways:

1. Two hundred questionnaires were sent to supervisors and executives of plants throughout the New England and Middle Atlantic areas. The report of this survey, "Industry Speaks Out--to the Instructors of English," is attached.
2. A survey on "Writing and Speaking for Business and Industry" was made by Dr. Herman A. Estrin, of the Newark College of Engineering, who is Chairman of the Committee. Fifty engineering companies participated in this survey.
3. An investigation of the kinds of writing situations confronting 50 supervisors and engineers in 9 plants of General Motors was conducted by members of the English Section of General Motors Institute and is reported in the "Corporation Writing Survey."

The results of these surveys were analyzed to find out the kind of writing industry does, the problems of writing that industry has, and the recommendations that industry makes concerning the teaching of college English.

Kinds of Writing Situations in Industry

A survey of General Motors plants revealed a wide variety of writing situations--from the simple AVO (Avoid Verbal Orders) memorandum to a long investigational project report. Where the writing situation did not vary much, as in laboratory reports, a set format was used. Many of the longer engineering project reports, however, presented more of a problem of organization, depending upon the readers. Almost all of the reports provided for quick reading, with either a summary abstract or a conclusions or summary section immediately following the introduction. Background information was very brief or was omitted altogether in reports to readers who were familiar with the situation; but it was usually extensive and somewhat detailed when the report went to some readers outside the writer's department.

To give further evidence of the great variety of reports in industry is a list of writing situations in aircraft and aerospace industries compiled by Dr. Fred MacIntosh and presented to a CCCC workshop in 1962. This list, appended to this report, classifies reports very broadly, as Corporate Level and Divisional Level and then in a number of general categories.

Writing Problems

The report "Industry Speaks Out" lists 37 quotations as representative of the replies. Almost all of these quotations concerned writing problems. Among the chief problems mentioned were those of basic composition, such as grammar, spelling, and punctuation--mentioned 14 times; style of writing, such as clearness, conciseness, and directness, mentioned 14 times; and the presentation and organization of the data, mentioned 13 times. Logical expression was listed 4 times.

In the "Corporation Writing Survey," the problems were listed under four categories: Writing for the Reader, Basic Composition, Data, and Conciseness and the Quick Picture.

The personnel in the engineering companies responding to Dr. Estrin's survey said that the lack of unity and logic, conciseness, and coherence was the chief weakness of writers in their firms. Poor grammar, punctuation, and spelling were additional defects in writing.

On the whole, the replies indicate that basic composition is the area of most concern in industry, but that conciseness and clarity of style and the presentation and organization of data are also weaknesses of writers.

Recommendations by Industry

In "Writing and Speaking for Business and Industry," most of the suggestions to college English departments to improve writing were in the area of basic English: grammar, spelling, etc. Writing clearly and concisely and writing for the nontechnical reader were also stressed. As much emphasis is given speech as writing in this survey. The following is a quotation from the report:

> "Business and industry feel that the most important types of speech which a prospective engineer should practice are the conference, dictation, panel discussions, speeches of demonstration, interviews, speeches for special occasions, and speeches of persuasion."

Two important recommendations by industry are included in "Industry Speaks Out": (1) that high standards of English be required on all written papers in all discussions in every course in college, and (2) that students be encouraged to read "well-written literature pertaining to science and engineering."

The "Corporation Writing Survey" does not contain recommendations, but the report infers that colleges teach the student to adapt his writing to various situations, as in this passage:

> "The variety of written communications described reinforces the general principle that the form, contents, and organization of every document are determined by the variables (reader, writer, material, and intended use) of the situation which calls for it."

Summary

Although any conclusions drawn from limited data must be considered tentative, the three surveys reveal results in common that should not be overlooked by college English departments. Writing in industry is weak in basic compostion, which industry would most like to see stressed in schools. Lack of clearness and conciseness is mentioned a number of times as being another great fault. Finally, the wide variety of writing situations confronting the writer in industry calls for adaptation on his part, and colleges should give the technical or scientific student practice in writing reports to meet different occasions.

In one of the surveys, industry strongly recommended speech courses where the student practiced speaking in realistic situations.

The reading of good literature was also mentioned as important in helping the student to improve his writing.

Good college courses in English composition, technical writing, speech, and literature, according to industry, would contribute much to the future success of college students in industrial careers.

INDUSTRY SPEAKS OUT--TO THE INSTRUCTORS OF ENGLISH

Dr. Herman A. Estrin, Newark College of Engineering

> Without a confident knowledge of the English language a man lacks the tools of making people understand and accept his ideas.

This above sentence was one of the many answers to a wide survey of business and industry concerned with science and technology to obtain information that may result in strengthening college English courses for the technical and scientific students.

The Committee on College for the Scientific and Technical Students, National Council of the Teachers of English, sent two hundred questionnaires to supervisors of technical writers, executives of small businesses and industry, and supervisors of engineers in plants throughout the New England and Middle Atlantic areas. The survey included the following questions:

1. As viewed by industry, describe college students' weaknesses in English.
2. Why does industry emphasize the study of English for scientific and technical students?
3. What are industry's suggestions for the students' need for instruction in technical writing?
4. How can the English instructor improve the engineer's quality of writing?

The results of the survey follow: (The single-spaced paragraphs are the exact words from executives in industry.)

The Problem as Viewed by Industry: College Students' Weaknesses in English

1. A lack of basic preparation in writing.

> If schools and colleges will train students in spelling, grammar, the composition of a simple and straightforward sentence, and in the art of expressing themselves clearly and directly, the students will have no difficulty in writing memoranda and reports, no matter what business they may enter....In recent college graduates, almost regardless of which school they attended, there is an appalling lack of basic preparation in writing.

2. A weakness in technical report writing.

> It has been my experience with young engineers that although they may be well informed and have obtained all the necessary information

on a problem, it is very difficult for them to prepare a report in a clear and concise manner. We believe, therefore, that the report writing courses in colleges will be of great value to the young engineers and to industry.

We find many recent engineering graduates are weak in the techniques of writing reports. Errors in grammar and sentence structure are a serious problem; the general weakness seems to be in composition. Generally, young engineers cannot organize a report logically or write with clarity.

3. A lack of ability to express themselves clearly and adequately.

Far too many college graduates enter industry without the ability to express themselves clearly and adequately. They lack a simplicity of vocabulary and a directness. We place emphasis upon these two points in order to minimize misunderstanding and to conserve time.

4. A lack of ability to express themselves logically.

Many of our employees come to us from college with the inability to express themselves logically. They have never been taught to size up the situation or problem and to direct their report to the discussion of the problem, their results, and their conclusions. They do not express themselves in a logical manner--one which can be readily comprehended by the person needing the information.

5. The lack of ability to use the exact expression of the intended meaning.

We find the proper use of English in technical writing to be of great importance, and all too often it is not achieved. We, therefore, welcome efforts to improve this situation and suggest particular emphasis on the exact expression of the intended meaning with a minimum of redundancy or superfluous words.

Industry's Reasons for Emphasizing the Study of English for Scientific and Technical Students.

Two of industry's supervisors of writing stated the following reasons:

An ability to communicate effectively with others is important in all branches of industry and at all levels.

This ability becomes particularly important as one enters management and advances to more responsible managerial responsibilities. It has been defined as a skill of management. More than this, "it is essential to every other management skill."

While the ability to communicate depends on many things, a sound understanding of good English usage and an ability to express oneself, in speaking and in writing, with reasonable fluency, is of fundamental importance. This ability requires an emphasis on English which is not always present in technical and scientific curriculums.

I firmly believe that a good command of English is required by technical people in order for them to communicate generally and to prepare clear and concise reports of their activities. Perhaps some colleges are permitting students to be graduated without taking the English courses that are offered. I would suggest. therefore, that your committee would be taking a proper action in emphaisizing the importance of the English courses which the engineer may have on his curriculum.

Industry's Suggestions for Students' Need for Instruction in Technical Writing

In technical writing, students need instruction in the following phases:

1. The mechanics of organizing and presenting the data and information for reports.

2. The summarizing of information (reports, etc.) in clear, concise language.

Greater emphasis should be placed on the ability to translate the scientific data which are obtained through experimentation into a clear, concise report.

3. The clarity of expression.

In reading reports we appreciate clarity of thought and conciseness of presentation. Because so many papers come across a supervisor's desk, brief, precise reports are essential.

4. The correct use of sentence structure, grammar, and punctuation.

Our experience would indicate that involved sentence structure, redundant phraseology, and indefinite reference are common faults of report writing today. A vague understanding of the mechanics of punctuation is also evident.

If he has a good grasp of grammar, composition, punctuation, spelling, and English usage, he seldom has trouble learning the accepted forms. This knowledge would apply equally to the preparation of reports. If he lacks this elementary ability to use our language, he will never be able to write effective reports no matter how much he studies "form."

5. The technique of legible writing.

A premium should also be placed on penmanship. It would appear that penmanship has become a lost art. To be able to read one's own writing is not enough, because many other people may have to read the report.

Improvement in penmanship and pride therein might also tend to produce better sentence structure, expression, and accuracy of statements. An easily readable umanuscript is more likely to be read than one that is illegible.

6. An understanding of the audience for whom the report is to be written.

An engineer should be able to size up the group of people who should read the report, and express himself so that all can understand the report without insulting anyone's intelligence. Students should be taught to organize their material, weed out what is unimportant, and clearly present their project in an interesting and logical manner.

7. An enforced adherence to rigid standards.

Perhaps the problem is in achieving the clarity of thought that must precede clarity of expression, and certainly one way of improving this is ability to practice writing with enforced adherence to rigid standards.

8. An encouragement of the use of dictating or tape-recording devices.

A good way to superimpose the speaking personality over the writing personality would be to encourage the use of dictating or tape-recording devices in preparing a rough draft from outline notes. This procedure would furnish a written report base restricted to essentials and would be in the writer's most natural delivery form.

Industry's Suggestions to Improve the Quality of Writing

To improve the quality of English learned by students in engineering college, industry suggested the following:

1. Stress the procedural phases of English.

One assumes that the term "English" means composition and other forms of writing courses vis-a-vis the literature of the English-speaking people. It is within that frame of reference that I shall suggest to you what can be done to improve the teaching of English to technical and scientific students.

For the technical and scientific student the procedural aspect of good writing is perhaps more natural than with the liberal arts student. Engineering students are trained to think of subjects in categories much the same as steps in a mathematical solution to a problem. For the engineer he is then one up.

The technician must learn to separate his thoughts clearly and to set the thoughts on paper so that the reader sees them as clearly as does the writer. Whether it be listing separately all the ideas to be presented or whether it be another system, clear exposition turns on categorized thoughts.

2. Require high standards of English on all written papers and in all discussions.

As is now required by some colleges, every course should be, in effect, an English course with high standards required on all written papers and examinations and in oral classroom discussions.

There should be a supplemental grade pertaining to the written and verbal attainments of each student throughout his college career.

We realize that the extreme basic aptitudes and interests of some students would make such a program difficult; however a standard correlation of satisfactory achievement could be developed for students in various categories. Although we feel that everything possible should be done to improve the communications skills of students, we do not think that the grade of the subject being studied should be affected by their inability to achieve a high level in this area.

3. Teach logical exposition of pertinent facts followed by properly drawn conclusions.

Our recommendation for your consideration is that you consider strengthening college English courses with the goal of teaching logical exposition of pertinent facts followed by properly drawn conclusions. They must be taught to eliminate all extraneous factors and to write with the view of imparting information to others in a clear, concise manner. Admittedly, for a student to write in this manner, he must understand the subject thoroughly.

4. Assign reports and summaries of complicated scientific data.

In strengthening the college English courses for the technical and scientific student, we recommend that the students be assigned reports; that the students be asked to summarize complicated scientific data. They must be given the opportunity and be encouraged to understand thoroughly the subject before they attempt to summarize it. The person grading the report must know the subject thoroughly in order to evaluate critically the quality of the scientific writing.

5. Develop the student's ability to communicate by writing and by speaking.

The emphasis should be on the ability to communicate by writing and by speaking. It is assumed that before a student reaches the college level he has mastered proper grammar; the college courses should assist him in developing his communicative skills. In addition, such students should have more broadening in reading well-written literature pertaining to science and engineering.

I agree with (the above) comments on strengthening English courses in colleges for the technical and scientific student. However, I further feel that more emphasis should be put on the ability to communicate by writing in a more brief and concise manner.

6. Include a course with grammar fundamentals and vocabulary.

It is suggested that all college curriculums contain a concentrated two-year refresher course beginning with grammar fundamentals. It should stress vocabulary building and continue to give practice in written and verbal expression.

Thinking of language as a tool, one could certainly say that thoughts should be presented simply, clearly, and consecutively. Grammatical errors and misspelling--two common weaknesses--should be avoided not only because they may introduce an error in meaning, but because they call attention to themselves.

7. Encourage students to read classics, semi-technical articles and current periodicals.

To make his writing interesting, sensitive, and perceptive, the technician may be required to use facilities never before demanded. To improve these qualities, I suggest reading as the aid to good writing.

As a partial list of well-written publications for engineers to peruse, the Economist, Foreign Affairs, Scientific American and The New Yorker are easily available sources of good writing. Brilliant scientifically oriented authors writing on a variety of subjects are J. B. Conant and Robert Oppenheimer.

Perhaps for most people a writing facility cannot be developed easily and must be preceded by the recognition of good writing which comes from exposure to good writers. These might include not only the classics but some semi-technical articles and current periodicals.

8. Use teaching machines in grammar and usage classes for technical and scientific students.

"The effective writing of English is the greatest asset to scientific and technical personnel," says Industry. Executives in industry said the following in regard to the quotation:

It has been my pleasant experience to have made the acquaintance of some of the nation's well-known scientific and technical writers. Aside from a good command of English and an interesting method of presenting factual data, these people all have one thing in common. They have the energy and intelligence to take the time to understand thoroughly the subject about which they are writing.

The greatest asset that an employee can have is the ability to convey written information clearly and concisely.

A man's ability to communicate the knowledge that he has absorbed is rated almost equally with his power to absorb it.... We have many employees who know their work thoroughly and yet are not reaching top-level jobs, principally because they cannot write brief, well-constructed, and understandable reports.

Ability to express ideas clearly, concisely and persuasively is an asset in most industrial positions and a necessity at the managerial level.

It was heartening to the Committee to have industry write the following:

> Those of us in Industry strongly endorse your proposed program and wish you the best of success in its rapid accomplishment.

Survey prepared by
Professor Merrill Sherman
University of Hartford
Hartford, Connecticut

WRITING AND SPEAKING FOR
BUSINESS AND INDUSTRY

A Survey of Fifty New Jersey Engineering Companies

Prepared by

Dr. Herman A. Estrin

Newark College of Engineering

WRITING AND SPEAKING FOR BUSINESS AND INDUSTRY

Good English expression is becoming more important every year to the business and professional man. It is an opportunity, in many cases the only opportunity, for the young business or professional man to make a favorable impression on those "at the top." The quality of his writing or speaking ability can make or break him.

This observation came from a supervisor of engineer writers in ono of the large engineering research centers in the East.

What do business and industry expect from English instructors of engineering students? How can the instructor adapt his teaching methods so that the student will receive the maximum benefit from his course in English? What do business and industry find to be the weaknesses of writers? What types of speech should be practiced by students who will enter business or industry?

To learn the answers to these questions, the writer sent a questionnaire to fifty New Jersey engineering companies, which were most cooperative and helpful in completing it.

As for the kinds of writings which are required to be written by most engineers, the following were listed: internal, technical, and progress reports; letters of inquiry and instruction; laboratory reports; technical articles and papers; abstracts; and sales letters. Other types of writing mentioned were the examination--trip report, bid proposals, and technical correspondence.

The lack of unity and logic, wordiness and repetition, and the lack of coherence are the most prominent weaknesses of the writers in business and industry. Ineffective sentence structure, the lack of vocabulary, improper punctuation, and poor spelling were additional weaknesses of writers. Other defects in writing are errors in tense, reference of pronouns, use of idiom parallelism, and agreement of subject and verb.

To the question:

In the preparation for more effective writers, what can the Department of English do to assist business and industry? The responses suggested the following:

1. Emphasize the importance of good grammatical construction and the correct choice of words.
2. Stress the need for complete sentences, increase vocabulary, correct spelling, and the unity and logic of writing.
3. Impress upon the student that each of his writing efforts should be designed and accomplished with the same degree of care and attention to detail that is required of any engineering design. Every flaw weakens the structure and renders the design less valuable.
4. Instill in the student a strong appreciation of the importance of good writing and effective speaking ability in relation to job advancement.
5. Provide a basic training in syntax and sentence structure and show the student how to apply this background.
6. Stimulate an interest in and appreciation of "quality" professional writing. Then give the student enough practice in writing and speaking to develop self-confidence.
7. Stress simplicity of form and necessity for a direct transfer of information.
8. Offer extensive drill on the use of outlines and grammar.
9. Suggest that students be asked on a voluntary basis to submit for analysis and criticism the technical papers and reports written for other courses.
10. Require higher standards in quality of writing through an intensified training program.

11. Stress logic and continuity of thought.
12. Create pride in fashioning sentences that tell a story simply and directly.

Speech teachers may be interested to learn that business and industry feel that the most important types of speech which a prospective engineer should practice are the conference, dictation, panel discussions, speeches of demonstration, interviews, speeches for special occasions, and speeches of persuasion. Several answers stated that engineers should learn the art of conversation.

What kind of training do you think that our public speaking instructors should give those students who will enter business and industry? The following were suggested:

1. Practice speaking before groups to gain poise and ability to think on feet.
2. Teach "general conversation."
3. Offer training in expository speaking so that conversations, speeches, and/or explanations will reflect the individual's true knowledge of his subject. This training should eliminate the too frequent "I mean's," "in-other-words," the now-popular "actually's," which seem to indicate an inferior ability to explain or a lack of confidence on part of the speaker.
4. Give as much planned and extemporaneous speaking as is possible in order to overcome self-consciousness.
5. Provide sufficient speaking experience to develop confidence and poise.
6. Train him to speak fluently and enthusiastically.
7. Stress extemporaneous and informal talks.
8. Develop logical build-up of subject and ability to summarize adequately.

9. Encourage ease and relaxation of speaker to transfer important points of information.

10. Emphasize the importance of careful and sound planning. Make the student realize that he is speaking for a specific audience, not for himself, and that he should tailor his material and presentation for that audience.

If you were to speak to the chairman of the Department of English who will supply your prospective employees, what kind of training in writing and speaking is most necessary?

1. Organization of material in clear, logical sequence.
2. Elimination of unessential material.
3. Development of logical build-up of subject.
4. Ability to speak convincingly.
5. Poise before a group.
6. Expression of ideas in a clear, concise form.
7. Ability to make a non-technical man know about what you are talking.
8. Preparation of good outlines in order that the writing will follow a unified, logical, coherent format.
9. Training in exactness in choice of words and phrases.
10. Ability to say just what one intends to say and what one really means.
11. Accurate and complete subject description.
12. Clarity of expression to insure full comprehension by the second person.
13. A thorough grounding in the fundamental of English expression.
14. Ability to organize and plan before writing.
15. Ability to write brief, complete, and accurate letters.
16. A complete, thorough knowledge of English backed by many hours of nonfiction reading.

Interesting comments which supervisors of business and industry made concerning the writing and speaking abilities of college-trained men are as follows:

> Many engineers do not take the time and the care to turn out completely finished writings. Many otherwise good reports and letters suffer from occasional typographical errors, poor sentence structure, ambiguities, and lack of supporting logic for conclusions. There is no place for a partly finished job in technical writing.

> With engineers the importance of writing and speaking is not fully appreciated, and latent capabilities never fully exploited.

> English should be studied in College primarily as a communication medium and ample opportunity should be provided for practice in the art of writing.

> A very high value is placed on facility in oral and written expression by most employers of engineers. Nevertheless, most undergraduate engineers do not appear to appreciate the importance of this phase of their training. Their motivation, the Department of English needs the cooperation of the entire engineering faculty.

WRITING SITUATIONS IN AIRCRAFT AND AEROSPACE INDUSTRIES

Dr. Fred MacIntosh, University of North Carolina.
Chapel Hill, North Carolina

I Corporate Level

II Divisional Level
    A Management
    B Engineering
    C Production
    D Field Service

Corporate Level Writing Situations

1 Annual report to stockholders
2 Annual report to Department of Defense
3 Annual report to board of directors
4 Annual reports of vice-presidents
5 Periodic letters to stockholders
6 Periodic information sheets to stockholders
7 Periodic research and development statements to stockholders
8 Public relations releases
9 Industrial relations releases
10 Industrial relations directives to divisions
11 Accounting directives to divisions
12 Policy statements to divisions
13 Long-range projections
14 Facilities reports
15 Technical and professional personnel resources statements
16 Willingness to commit corporate funds statements
17 Government and Armed Forces liaison statements
18 Organizational statements
19 Information memoranda within corporate level
20 Guidelines to division management
21 Information memoranda to division management
22 Programs evaluation statements
23 Market research studies
24 Market evaluation reports
25 Research and development statements
26 Performance reports
27 Letters (Millions)
28 Speeches (public occasions, industry occasions, professional meetings
29 Scripts for films, slides, oral presentations
30 Charts, guides, exhibits (for oral presentations)

Divisional Level Writing Situations

1 Annual report to corporate level
2 Periodic reports to corporate level
3 Policy statements
4 Long-range projections

5 Directives
6 Information statements for internal distribution
7 Public relations writing
    News releases
    Feature stories
    Speeches
8 Aids to sales promotion
    Brochures
    Folders
    Scripts for films
    Scripts for oral presentations
    Charts for oral presentations
9 Industrial relations writing
    Directives to subcontractors
    Information statements to subcontractors
    Guidelines to subcontractors
    Contracts with subcontractors
    Contracts with unions
    Employee information statements
    Company newspaper
    Job classification statements
    Job description statements
    Salary schedules statements
    Personnel evaluation guides
    Recruiting brochures, folders, letters
    College recruiting correspondence
    Industrial recruiting correspondence
    Training guides (texts, scripts, visuals)
        For employees
        For subcontractors
        For customers
    Resources statements
        Facilities
        Present commitment of facilities
        Technical and professional personnel
        Labor force
        Training programs
        Management record
        Documentation support capabilities
    Internal promotion programs
        Safety
        Security
        Value analysis
        Quality assurance
        Civil defense
    Air Force and NASA liaison writing (all sorts)
10 Proposals for
    Contract research
    Contract research and development
    Prime Contracts
    Major subcontracts
    Smaller subcontracts
11 Engineering reports
    Design reports
    Research reports
    Research and development reports
    Progress reports
    Periodic reports
    Final reports

12 Manufacturing reports
    - Production reports
    - Research reports
    - Equipment and facilities reports
    - Time and motion studies
    - Assembly-grouping reports
    - Systems reports
    - Hydraulics reports
    - Testing reports
    - Quality assurance reports

13 Field service reports
    - Performance reports
    - Evaluation reports
    - Recommendation reports

14 Manuals
    - Operational manuals
    - Maintenance manuals
    - Design manuals
    - Graphics and printing manuals
    - Report-writing manuals
    - Correspondence manuals
    - Air Force and NASA manuals

BIBLIOGRAPHY

I. SUGGESTIONS FOR MORE EFFECTIVE WRITING

Articles

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, "Guide to Authors and Guide to Speakers." New York.

ANDERSON, J., and M. W. THISTLE, "On Writing Scientific Papers." Bulletin of The Canadian Journal of Research, Vol. 75 (1947).

BAUM, H., "Writing--Newest Engineering Skill." Electronic Industries, Vol. 20 (March 1961), pp. 278-82.

BENNETT, JOHN B., "Better Writing: New Answers for an Old Problem." IRE Transactions on Engineering Writing and Speech, EWS-4 (May 1961), pp. 44-46.

BONNER, MICHAEL K., "Technical Writing by Engineers." Machine Design, Vol. 30 (June 26, 1958), pp. 90-95.

BROOKES, B. C., "Report Writing Improves Morale." Engineering, Vol. 191 (March 1961), pp. 315-16.

BROWN, H., "Technical Writing for Engineers." Midwest Engineer, Vol. 7 (July 1954), pp. 7-8.

CARROLL, JOHN M., "Keys to Good Article Writing." IRE Transactions on Engineering Writing and Speech, EWS-2 (December 1959), pp. 78-82.

CEDERBORG, G. A., "Engineering Writing to Eliminate Gobbledygook." Machine Design, Vol. 29 (March 1957), pp. 80-82.

CORTELYOU, ETHALINE, "To-day Accuracy Demands the First Person in Technical Reports." Chemical Engineering, Vol. 65 (November 1958), pp. 147-48.

DEVRIES, H. B., "Writing Aptitude or Attitude?" Mechanical Engineering, Vol. 83 (February 1961), pp. 36-37.

ELDER, J. D., "Jargon, Good and Bad." Science, Vol. 119 (April 23, 1954), pp. 536-38.

GARN, S. M., "Five Fundamentals That Make Interesting Technical Papers." Combustion, Vol. 32 (September 1960), pp. 51-56.

GOULD, JAY R., "What Does the Reader Like?" Chemical and Engineering News, Vol. 34 (January 23, 1956), p. 406.

GRAY, J. P., "Technical Writing." Special Libraries, Vol. 46 (September 1955), pp. 317-18.

HICKS, TYLER J., "How to Write Reports That Get Read." SAE Journal, Vol. 68 (November 1960), pp. 75-79.

HOLMSTROM, E., "English, the Universal Technical Language?" Engineering, Vol. 187 (February 6, 1959), pp. 168, 169.

"How to Learn to Write." Time, May 23, 1960, pp. 47-48.

JARMAN, BRIAN D., "Six Steps to Effective Engineering Writing." Machine Design, Vol. 32 (April 14, 1960), p. 190.

KLASS, P. J., "How to Prepare Papers the Easy Way." Aviation Week, Vol. 65 (July 2, 1956), pp. 69-71.

KENT, J. L., "The ABC's of Better Writing." Petroleum Refiner, Vol. 36 (November 1957), pp. 361-63.

____, "Bad Technical Writing." Mechanical Engineering, Vol. 79 (December 1957), p. 1153.

____, "Engineers Can Write Better Technical Reports." Chemical and Engineering News, Vol. 33 (January 31, 1955), pp. 444-45.

____, "Engineers, Do Your Own Writing." Electronic Industries, Vol. 16 (December 1957), pp. 108-09.

____, "How to Write Better Articles." Petroleum Engineer, Vol. 29 (March 1957), pp. 32-34.

MATTHEWS, P. A., "Engineers and English." *Industrial Science and Engineering*, Vol. 5 (October 1958), pp. 13-15.

MCCARTNEY, E. S., "Does Writing Make an Exact Man?" *Science*, Vol. 119 (April 23, 1954), pp. 525-28.

McDANIEL, H. C., "Help Wanted: Engineers Must Be Able to Write." *Industrial and Engineering Chemistry*, Vol. 48 (July 1956), sup., p. 47A.

MORGAN, A. M., "Writing--Key to Your Engineering Development." *Electronic Industries*, Vol. 20 (February 1961), pp. 212-14.

MOWBRAY, A. Q., "A Pig Is a Pig Is a Pig." *ASTM Bulletin*, October 1959, pp. 18-19.

MURDICK, ROBERT G., "Engineering and Research Reports." *Machine Design*, Vol. 33 (August 13, 1961), pp. 70-75.

MURPHY, E. A., "Let's De-Gobbledygook Technical Writing." *Industrial Marketing*, Vol. 41 (October 1956), pp. 58-60.

PATRICK, W. W., "English?"*Bulletin of American Association of Petroleum Geologists*, Vol. 38 (December 1954), pp. 2558-61.

PEARSON, JACK W., "How to Write an Engineering Report." *Industrial Science and Engineering*, January 1959, pp. 16-18.

"Piercing the Technology Curtain." *Chemical Week*, Vol. 79 (September 8, 1956), p. 56.

"Poor Writing: A Growing Problem for College Students: Law School Deans Analyze Weaknesses in a Basic Skill." *U.S. News and World Report*, November 23, 1959, pp. 68-70.

PRINCE, MARTIN V. H., " A Test for Writing Aptitude." *Journal of Engineering Education*, Vol. 48 (June 1958), pp. 897, 901, 993.

_____, "It Ain't Necessarily So; Short Words and Simple Sentences Are Not Necessarily the Clue to Clarity and Readability." *Chemical and Engineering News*, Vol. 33 (August 22, 1955), p. 3513.

ROSS, S. H., "The Engineer as a Writer." *Mechanical Engineering*, Vol. 83 (February 1961), pp. 122-23.

"Science Need Not be Inarticulate Round Table Talk." *Electronics*, Vol. 31 (January 10, 1958), pp. 20-21.

SHAW, E. W., "The Ten Commandments for Technical Writers." *Science*, Vol. 121 (April 15, 1955), p. 567.

SMITH, W. J., "The Labor of Technical Writing." *ASTM Bulletin* (December 1960), p. 12.

SOUTHER, JAMES W., "Applying Engineering Method to Report Writing." *Machine Design*, Vol. 24 (December 1952), pp. 114-18.

SPANGLER, E. R., "Modern Grammar and Its Application to Technical Writing." *Journal of Chemical Education*, Vol. 33 (February 1956), pp. 61-64.

STEINER, P., "Want to Improve Your Technical Writing?" *Heating, Piping, and Air Conditioning*, Vol. 29 (August 1957), pp. 102-05.

STRUCK, H. R., "A Recommended Diet for Padded Writing." *Science*, Vol. 119 (April 23, 1954), pp. 522-25.

SYLVESTER, W. A., "Technical Writing Isn't Easy, but . . ." *Petroleum Refiner*, Vol. 37 (April 1958), pp. 253-55.

TRUESDELL, C., "A Comment on Scientific Writing." *Science*, Vol. 120 (September 10, 1954), p. 434.

WILSON, J. H., "A Few Hints on Word Usage." *Journal of Chemical Education*, Vol. 33 (November 1956), pp. 577-80.

_____, "Our Constantly Changing Language." *Journal of Chemical Education*, Vol. 34 (September 1957), pp. 447-49.

Books

BALL, JOHN, and CECIL WILLIAMS, Report Writing. New York: Ronald 1955.

BUCKLER, WILLIAM E., and W. C. McAVOY, American College Handbook. New York: American, 1960.

CORBIN, RICHARD K., and PORTER G. PERRIN, Guide to Modern English. Chicago: Scott, Foresman, 1962.

CROUCH, WILLIAM G., and ROBERT L. ZETLER, A Guide to Technical Writing, 3rd ed. New York: Ronald, 1962.

DOUGLASS, PAUL, Communication Through Reports. Englewood Cliffs, N.J.: Prentice-Hall, 1957.

EMBERGER, META RILEY, and MARIAN R. HALL, Scientific Writing. New York: Harcourt, Brace & World, 1955.

ESTRIN, HERMAN A., Technical and Professional Writing: A Practical Anthology. New York: Harcourt, Brace & World, 1963.

FLESCH, RUDOLF, The Art of Readable Writing. New York: Harper, 1949.

GATNER, ELLIOTT S. M., and FRANCESCO CORDASCO, Handbook for Research and Report Writing. New York: Barnes and Noble, 1948.

GAUM, CARL G., HAROLD F. GRAVES, and LYNE S. S. HOFFMAN, Report Writing, 3rd ed. Englewood Cliffs, N. J.: Prentice-Hall, 1950.

GUNNING, ROBERT, The Technique of Clear Writing. New York: McGraw-Hill, 1950.

HARWELL, GEORGE C., Technical Communication. New York: Macmillan, 1960.

HICKS, TYLER G., Writing for Engineering and Science. New York: McGraw-Hill, 1961.

IVES, SUMNER, A New Handbook for Writers. New York: Knopf, 1960.

JONES, W. PAUL, Writing Scientific Papers and Reports, 4th ed. Dubuque, Iowa: Browh, 1959.

Kapp, REGINALD O., The Presentation of Technical Information. New York: Macmillan, 1957.

KEREKES, FRANK, AND ROBLEY WINFREY, Report Preparation, Including Correspondence and Technical Writing, 2nd ed. Ames, Iowa: Iowa State College Press, 1951.

LEGGETT, GLENN, et al., Handbook for Writers. Englewood Cliffs, N.J.: Prentice-Hall, 1960.

LESIKAR, RAYMOND V., Report Writing for Business. Homewood, Illinois: Irwin, 1961.

MANDELL, SIEGFRIED, Writing in Industry. New York: Polytechnic, 1960.

McPEEK, JAMES A., and AUSTIN WRIGHT, Handbook of English. New York: Ronald, 1956.

MENZEL, DONALD H., et al., Writing a Technical Paper. New York: McGraw-Hill, 1961.

MILLER, WALTER JAMES, and LEO E. A. SAIDLA, Engineers as Writers. Princeton: Van Nostrand, 1953.

MILLS, GORDON H., and JOHN A. WALTER, Technical Writing, rev. ed. New York: Holt, Rinehart and Winston, 1962.

MITCHELL, JOHN, Handbook of Technical Communication. Belmont, California: Wadsworth, 1962.

NELSON, J. RALEIGH, Writing the Technical Report, 3rd ed. New York: McGraw-Hill, 1952.

RHODES, FRED H., Technical Report Writing. New York: McGraw-Hill, 1961.

SCHUTTE, W. M., and ERWIN R. STEINBERG, Communication in Busihess and Industry. New York: Holt, Rinehart and Winston, 1960.

SHERMAN, THEODORE A., Modern Technical Writing. Englewood Cliffs, N.J.: Prentice-Hall, 1955.

SIGBAND, NORMAN B., Effective Report Writing. New York: Harper, 1960.

SOUTHER, JAMES W., Technical Report Writing. New York: Wiley, 1957.

STEVENSON, BRENTON W., et al., English in Business and Engineering. Englewood Cliffs, N. J.: Prentice-Hall, 1950.
STRUNK, WILLARD, JR., The Elements of Style, rev. by E. B. White. New York: Macmillan, 1959.
SYPHERD, W. O., et al., Manual of Technical Writing. Chicago: Scott, Foresman, 1957.
TRELEASE, SAM F., The Scientific Paper: How to Prepare It, How to Write It, 2nd ed. Baltimore: Williams & Wilkins, 1951.
TUTTLE, ROBERT E., and C. A. BROWN, Writing Useful Reports. New York: Appleton-Century-Crofts, 1956.
ULMAN, JOSEPH N., and JAY R. GOULD, Technical Reporting, rev. ed. New York: Holt, 1959.
WEIL, BENJAMIN H., ed., The Technical Report: Its Preparation and Processing, and Use in Industry and Government. New York: Reinhold, 1954.
WICKER, C. V., and W. P. ALBRECHT, The American Technical Writer. New York: American, 1960.
WOOLLEY, EDWIN C., and FRANKLIN W. SCOTT, College Handbook of Composition, 4th ed. Boston: Heath, 1958.

Reference Works

General Dictionaries

CHASE, STUART, The Tyranny of Words. New York: Harcourt, Brace & World, 1938.
COLLINS, VERE H., The Choice of Words: A Book of Synonyms with Explanations. London: Longmans, Green, 1952.
EVANS, BERGEN and Cornellia, A Dictionary of Contemporary American Usage. New York: Random House, 1957.
FLOWLER, HENRY W., A Dictionary of Modern English Usage. New York: Oxford University Press, 1959.
GOWERS, SIR ERNEST A., Plain Words: A Guide to the Use of English. London: His Majesty's Stationery Office, 1948.
______, Plain Words: Their ABC. New York: Knopf, 1955.
HORWILL, HERBERT W., A Dictionary of Modern American Usage. Oxford, England: Clarendon, 1935.
NICHOLSON, MARGARET, A Dictionary of American-English Usage, Based on Fowler's Modern English Usage. New York: Oxford University Press, 1957.
OPDYCKE, JOHN B., MARK MY WORDS: A Guide to Modern Usage and Expression. New York: Harper, 1949.
Roget's International Thesaurus, rev. ed. New York: Crowell, 1946.
Webster's Dictionary of Synonyms. Springfield, Mass. 1 Merriam, 1951.

General Style Manuals

American Psychological Association, Publication Manual, rev. ed. Washington, D. C., 1957.
CAMPBELL, WILLIAM G., Form and Style in Thesis Writing, rev. ed. Boston: Houghton-Mifflin, 1954.
COLE, ARTHUR H., and KARL W. BIGELOW, A Manual of Thesis Writing for Graduates and Undergraduates. New York: Wiley, 1934.

HURT, PEYTON, Bibliography and Footnotes: A Style Manual for College and University Students, rev. and enl. by Mary L. Hurt Richmond. Berkeley: University of California Press, 1949.

A Manual of Style, 11th ed. Chicago: University of Chicago Press, 1949.

WILLIAM RILEY PARKER, ed., The MLA Style Sheet, rev. ed. New York: The Modern Language Association of America, 1959.

TURABIAN, KATE L., A Manual for Writers of Term Papers, Theses and Dissertations, rev. ed. Chicago: University of Chicago Press, 1955.

United States Government Printing Office Style Manual, rev. ed. Washington, D. C.: Government Printing Office, 1959.

TECHNICAL AIDS

American Institue of Physics, Style Manual, 2nd ed. New York, 1959.

Civil Engineers Encyclopedia Dictionary. Los Angeles: Bensen, 1930.

CONSODINE, DOUGLAS MAXWELL, ed., Process Instruments and Control Handbook. New York: McGraw-Hill, 1957.

CRISPIN, T. S., Dictionary of Technical Terms, rev. ed. Milwaukee: Bruce, 1948.

ENGINEERS' YEARBOOK OF FORMULAE, RULES, FABLES, DATA, AND MEMORANDA FOR 1894-1958. London: Morgan.

ESHBACH, OVID WALLACE, Handbook of Engineering Fundamentals, 2nd ed. New York: Wiley, 1952.

GRAY, DWIGHT E., ed., American Institute of Physics Handbook. New York: McGraw-Hill, 1957.

HAYNES, W., Chemical Trade Names and Commerical Synonyms, 2nd ed. Princeton: Van Nostrand, 1955.

HEFLIN, W. A., The United States Air Force Dictionary. Princeton: Van Nostrand, 1956.

HERKIMER, HERBERT, Engineers' Illustrated Thesaurus. New York: Chemical, 1952.

HETENYI, MIKLOS I., Handbook of Experimental Stress Analysis. New York: Wiley, 1950.

HOPKINS, ALBERT A., ed., The Standard American Encyclopedia of Formulas. New York:: Grossett & Dunlap, 1953.

HUDSON, RALPH C., The Engineers' Manual, 2nd ed. New York: Wiley, 1939.

JACOBSON, CARL A., ed., Encyclopedia of Chemical Reactions. New York: Reinhold, 1946.

KIRK, RAYMOND E., DONALD T. OTHMER, et al., eds. Encyclopedia of Chemical Technology, 15 vols. New York: Interscience Encyclopedia, 1947-56.

MANTELL, CHARLES L., ed., Engineering Materials Handbook. New York: McGraw-Hill, 1958.

MINER, DOUGLAS F., and JOHN B. SEASTONE, eds., Handbook of Engineering Materials. New York: Wiley, 1955.

NATIONAL RESEARCH COUNCIL, A Glossary of Terms in Nuclear Science and Technology. New York: American Society of Mechanical Engineers, 1957.

NEWARD, MAXIM, Illustrated Technical Dictionary. New York: Philosophical Library, 1944.

O'ROURKE, CHARLES E., ed., General Engineering Handbook, 2nd ed. New York: Chemical, 1940.

SANDY, A. H., Dictionary of Engineering Machine Shop Terms. New York: Chemical, 1944.

STOUTENBURGH, JOHN LEEDS, ed., *Dictionary of Arts and Crafts.* New York: Philosophical Library, 1956.

THURSTON, ALAN PETER, ed. *Handbook of Engineering Formulae and Data*, 34th ed. London: Spon, 1951.

TWENEY, C. F., and L. E. C. HUGHES, *Chamber's Technical Dictionary*, 3rd ed. New York: Macmillan, 1958.

VAN MANSUM, C. J., *Dictionary of Building Construction*. Princeton: Van Nostrand, 1959.

VISSER, A., *Telecommunication Dictionary*. Princeton: Van Nostrand, 1959.

GRAPHIC AIDS

AMERICAN STANDARDS ASSOCIATION, *Abbreviations for Use on Drawings*, rev. ed. New York, 1950.

AMERICAN STANDARDS ASSOCIATION, *Engineering and Scientific Graphs for Publications*, New York, 1943.

ARKIN, HERBERT, and RAYMOND R. COLTON, *Tables for Statisticians*, New York: Barnes and Noble, 1950.

COHN, ERNST M., "Editing Graphs for Publication." Paper presented before the American Documentation Institute, Washington, D. C., 1954.

LUZADDER, WARREN J., *Graphics for Engineers*. Englewood Cliffs, N. J.: Prentice-Hall, 1951.

MODLEY, RUDOLPH, et al., *Pictographs and Graphs: How to Make and Use Them*. New York: Harper, 1952.

MYERS, JOHN H., *Statistical Presentation*. Ames, Iowa: Littlefield, Adams, 1950.

SCHMID, CALVIN T., *Handbook of Graphic Presentation*. New York: Ronald, 1954.

SPEAR, MARY ELEANOR, *Charting Statistics*. New York: McGraw-Hill, 1952.

II. TECHNICAL WRITING PROGRAMS

ARNOLD, CHRISTIAN K., "What the Technical Teacher Can Do To Improve Training in Writing Skills." *Journal of Engineering Education*, Vol. 48 (November 1957), pp. 90-95.

ESTRIN, HERMAN A., "Engineering Alumni Cite Need of Training in English. " *The NCE Alumnus*, Fall 1958, pp. 7-9.

______, "Engineering Alumni Discuss English." *The CEA Critic*, Vol. 22 (February 1960), p. 5.

______, "Outside Reading for Science Students." *Library Journal*, Vol. 83 (February 1, 1958), pp. 343-45.

______, "The Composition/Communication Course for the Technical and Engineering Student." *College Composition and Communication*, Vol. 40 (October 1959), pp. 182-84.

______, "Writing and Speaking for Business and Industry." *The CEA Critic*, Vol. 27 (November 1956), p. 4.

HEINMILLER, PAUL R., "How to Set Up a Writing Program for Engineers." *Machine Design*, Vol. 30 (September 4, 1958), pp. 104-08.

KOBE, K. A., "What Colleges Are Doing to Train Chemists and Chemical Engineers in Technical Writing." *Journal of Chemical Education*, Vol. 33 (February 1956), pp. 55-57.

LARSEN, J. A., "Wisconsin's Science Writing Program." *Science*, Vol. 123 (April 27, 1956), pp. 720.

RATHBONE, ROBERT R., "Co-operative Teaching of Technical Writing in Engineering Courses." *Journal of Engineering Education*, Vol. 49 (November 1958), pp. 126-30.

SCHWEIGERT, R. JR., "A Technical Writing Course That Works." *Journal of Engineering Education*, Vol. 46 (November 1955), pp. 262-66.

SPAGHT, MONROE E., "Industry Speaks Its Mind on Engineering Education." *Chemical Engineering*, Vol. 66 (June 1959), pp. 120-26.

WALDO, W. H., "Teaching Report Writing to Professional Chemists and Chemical Engineers." *Journal of Chemical Education*, Vol. 33 (February 1956), pp. 59-61.

WILLIAMS, G. E., "The Presentation of Technical Literature." *Journal of the Institute of Electrical Engineers*, May 1944, pp. 147-49.

III. TECHNICAL WRITING IN THE PROFESSIONAL WORLD

ALBRECHT, G. H. and JAY R. GOULD, "Technical Writing in Industry and Education." *Journal of Chemical Education*, Vol. 32 (August 1955), pp. 407-09.

AMERICAN CHEMICAL SOCIETY, "Hints to Authors of Papers to Be Presented at Meetings of the American Chemical Society." Washington, D. C., 1949.

BANNER, E. H. W., "Technical Publicity: Some Notes on Its Editorial Preparation." *Electrical Review* (London), Vol. 156 (April 15, 1955), pp. 633-34.

COHN, ERNST M., "A Systematic Approach to Manuscript Preparation." *Journal of Chemical Education*, Vol. 33 (October 1956), pp. 523-25.

CORTELYOU, ETHALINE, "Training of Chemists and Chemical Engineers for Technical Journalism." *Journal of Chemical Education*, Vol. 33 (February 1956), pp. 64-67.

ESTRIN, HERMAN A., "The Role of English in Industry as Observed by Evening Engineering Students." *The CEA Critic*, Vol. 21 (February 1959), pp. 3,8.

HAMLET, ROBERT T., "The Present Status of Technical Writing and Editing in Industry." *Special Libraries*, Vol. 47 (October 1956), p. 372.

MATTILL, JOHN I., "Writing as Communication: The Engineer Must Learn How to Reach His Constituents." *Journal of Engineering Education*, Vol. 44 (April 1954), pp. 476-78.

LIPMAN, MICHAEL, "How to Build Sales with House Organs." *Business Management*, November 1961, pp. 58-59, 102.

MACASKELL, ROBERT B., "Persuasion in Engineering Proposals." *IRE Transactions on Engineering Writing and Speech*, EWS-4 (May 1961), pp. 56-57.

MCDANIEL, H. C., and C. A. SCARLOTT, "Technical Writing Opportunities for Engineering Graduates." Pittsburgh: Westinghouse Electric Corporation.

McLAUGHLIN, R. R., "The Problem of Tomorrow's Technical Man Power." *Chemistry and Industry*, Vol. 6 (February 1956), pp. 117-20.

MORRISON, J. L., "How to Write an Article for Publication." *Public Works*, Vol. 86 (March 1955), pp. 103-04.

SHARP, HAROLD S., "Library and Laboratory Partners in Research." *IRE Transactions on Engineering Writing and Speech*, EWS-4 (May 1961), pp. 58-60.

SHRINER, R. L., "Suggestions to Authors of Articles for Chemical Reviews." Chemical Reviews, Vol. 55 (February 1955), pp. 1-8.

SLADE, I. M., and B. C. BROOKES, "Management Is Hampered by Bad Technical Writing." Engineering, Vol. 184 (August 2, 1958), pp. 137-38.

"Suggestions for Contributors to Science." Science, Vol. 123 (April 27, 1956), pp. 103-05.

"The Technical Interpreter." Engineer, Vol. 198 (July 30, 1954), pp. 171-72.

TROYAN, J. E., "Elements of Operating Manuals." Chemical Engineering, Vol. 68 (March 6, 1961), pp. 134-38.

WAGNER, E., "A Survey of Science Writers." Science, Vol. 119 (February 5, 1954), p. 179.

WILSON, J. H., "There'll Always Be an Editor." Chemical and Engineering News, Vol. 34 (February 20, 1956), p. 882.

WITHROW, LLOYD, "Better Technical Papers for SAE." SAE Journal, Vol. 67 (March 1959), pp. 82-84.

WITTNER, F., "Technical Writers and Artists." Agency Magazine, Vol. 48 (August 5, 1955), p. 62.

"Why Not Just Tell them? A Summary of Minneapolis-Honeywell Booklet for Technical Writers." Industrial Marketing, Vol. 42 (September 1957), pp. 55-58.

From Herman A. Estrin's Technical and Professional Writing: A Practical Anthology. New York: Harcourt, Brace and World, 1963.

Masterpieces of Science and Engineering

Science and engineering students sometimes find difficulty in writing their essays, reports, and articles. For this reason they often ask for examples of effective and interesting scientific and engineering writing. These selections were chosen to meet the many requests of these students; to illustrate deft writing by engineers, scientists, poets, essayists, and philosophers; and to help unfold in an informative manner the development of science and engineering. Despite the fact that some selections were written before the birth of Christ, they have a "modernity" about them and they obviously have survived the attrition of time.

In no way should this bibliography be considered as a survey or a history of science and engineering; however, it is a rich storehouse of the most helpful, enjoyable, and useful articles which concern science and engineering.

Agricola (Georg Bauer).	*The Education of a Mining Engineer* *The Smelting of Iron*	1490-1555
Aeneas the Tactician.	*Organization of Civilian Defense* *Fifth Columnists and Blackouts* *Incendiary Devices*	360 B.C.
Carl D. Anderson.	*The Elementary Particles of Physics*	
Archimedes.	*An Engineer Defends His City* *A Planetarium*	287(?)-212 B.C.
Othmar H. Ammann.	*Tentative Report on the Hudson River Bridge*	
Aristotle.	*The Egg and the Chick* *The Rainbow*	384-322 B.C.
J. J. Audubon.	*The Passenger Pigeon*	
Francis Bacon.	*Laboratories of the New Atlantis*	1561-1626
Roger Bacon.	*The Problem of Authority vs. Experience* *Lenses: A Prophecy*	1214(?)-1292
Vannoccio Biringuccio.	*De La Pirotechnia*	
J. Bronowski.	*The Creative Process*	1908-
Vannevar Bush.	*The Builders*	1890-
Gaius Julius Caesar.	*A Naval Battle* *Caesar Builds a Bridge*	44 B.C.
Rachel Carson.	*The Birth and Death of an Island*	
Geoffrey Chaucer.	*An Alchemist at Work*	1340(?)-1400
Benvenuto Cellini.	*A Ticklish Job of Casting*	1500-1571
Cleomedes.	*The Measurement of the Circumference of the Earth*	
Allan R. Cullimore.	*The Engineer's Oath*	
Eve Curie.	*The Discovery of Radium*	
Leonardo Da Vinci.	*A Genius Writes An Application Letter* *Natural Flight* *Mechanical Flight*	1452-1519
Proclus Diadochus.	*The History of Geometry to the Time of Euclid*	
Benjamin Franklin.	*Street Cleaning and Lighting in the 1750's* *Scientific Progress*	1706-1790

Sextus Julius Frontinus. An Honest Man Takes Public Office
De Aquis Urbis Roma A. D. 40(?)-103

William Gilbert. A Preface to Electromagnetism 1544-1603

Frederick Graham. Airplanes Debunk the Crow 1908-

Herodotus. Physicians and Funerals
Flood Control 425 B. C.

Paul R. Heyl. Space, Time and Einstein

Hippocrates. A Case of Childbirth Fever
The Hippocratic Oath

Homer. The Smith-God Makes a Shield 1000 B. C.

Herbert Hoover. Memoirs
The Principles of Mining
Report on the Mississippi Flood

Thomas Henry Huxley. The Uses of Science
The Method of Scientific Investigation 1825-1895

Hugo Iltis. Gregor Mendel and His Work

P. Isakov. Life in Sputnik

Sir James Jeans. Exploring the Atom

David S. Jenkins. Fresh Water from Salt

Samuel Johnson. A Dissertation on the Art of Flying 1709-1784

D. H. Killeffer. Two Ears of Corn, Two Blades of Grass

Benjamin G. Lamme. The Electrical Engineering Papers
Autobiography 1864-1924

Joseph Lister. On the Antiseptic Principle of Surgery

A. C. B. Lovell. Radio Stars

Lucretius. The Discovery of Fire
The Discovery of Metal
The Coming of Agriculture and Civilization 55 B. C.

Hiram Stevens Maxim. First Flight 1840-1916

John London McAdam. Remarks on the Present System of Road-Making 1756-1836

John Henry, Cardinal Newman. The Popular Notion of Education 1801-1890

William Barclay Parsons. Engineers and Engineering in the Renaissance
The American Engineers in France (1920)
Robert Fulton and the Submarine (1922)

John Captain Perry. The State of Russia Under the Present Czar
Account of the Stopping of the Daggenham Breach

H. S. Person. Engineering in the Encyclopedia of the Social Science

John Wesley Powell. Conquest of the Grand Canyon 1834-1902

Michael Pupin. Science and Truth 1858-1935

I. I. Rabi. Atomic Structure
My Life and Times as a Physician

William J. M. Rankine. Manual of the Steam Engine
Manual of Applied Mechanics
Manual of Civil Engineering 1820-1872

Arthur E. Raymond. The Well-Tempered Aircraft
Bouncing Crystal Ball

John Smeaton. Narrative of the Building of the Eddystone Lighthouse
1724-1792

J. W. N. Sullivan. The Reason for Science 1886-1937

Jonathan Swift. Gulliver Visits a Research Institute 1667-1745

Frederick W. Taylor. The Principles of Scientific Management 1856-1915

John E. Teeple. The Function of Chemical Engineering 1874-1931

Thomas Telford. Life
PontCrpylte Aqueduer
Eskdale 1757-1834

Merle A. Tuve. Is Science Too Big for the Scientist?

Thomas Tredgold. Charter for the Institute of Civil Engineers

John Tyndall. What is "Science"? 1820-1893

Vitruvius. Bricks
Theater Acoustics
Tests for Good Water
De Architectura

George Wald. The Origin of Life

Warren Weaver. Radiations and the Genetic Threat

Arthur M. Wellington. The Economic Theory of the Location of Railways
1847-1895

H. G. Wells. The Discovery of the Future 1866-1946

Dr. Herman A. Estrin, Professor of English
Department of English and Humanistic Studies
Newark College of Engineering
Newark 2, New Jersey

A Selected Bibliography for Instructors of English Interested in the Humanistic Social Curriculums of Engineering Education

American Society for Engineering Education. "General Education in Engineering." Journal of Engineering Education. 46 (April, 1956) 619-750.

______________, "Interim Report of the Committee on Evaluation of Engineering Education. Journal of Engineering Education. 45 (September, 1954) 40-66.

______________, "Report on the Evaluation of Engineering Education." Proceedings of the American Society for Engineering Education. 63 (1955) 26-60.

______________, "Summary of Preliminary Report, Committee on Evaluation of Engineering Education." Journal of Engineering Education. 44 (November, 1953) 143-147.

BURDELL, EDWIN S. "The Humanistic-Social Studies in the Engineering Curricula." Journal of Engineering Education. 46 (June 1955) 47-752.

EMBLER, WELLER. "The Integrated Program in the Humanities and Social Studies." Journal of Engineering Education. 50 (April, 1960) 644-649.

ERMENE, JOSEPH J. "The Convergence of Engineering and Liberal Arts Education." Journal of Engineering Education. 50 (April, 1960) 640-643.

ESTRIN, HERMAN A. "Engineering Alumni Advice to Freshmen on Studying English." College English 21 (November, 1959) 98-99.

______________, "Engineering Alumni Discuss English" The CEA Critic. 5 (February, 1960) 22-24.

______________, "Freshman English in Colleges and Universities in New Jersey." New Jersey English Leaflet 26 (March, 1963) 6-11.

______________, "Outside Reading for Science Students." Library Journal 83 (February 1, 1958) 343-345.

FATOUT, PAUL "Growth of the Humanistic Stem." Journal of Engineering Education. 38 (June, 1948) 715-720.

FOSTER, EDWARD "College English for Non-Major Students." College English 20 (May, 1959) 387-410.

GENERAL ELECTRIC COMPANY. "What They Think of Their Higher Education." Educational Relations Bulletin, January, 1957.

GREEN, ESTILL I. "Science and Liberal Education" Journal of Engineering Education. 47 (March, 1957) 548-552.

GREEN, THOMAS F. "A Humanities Teacher Looks at Engineering Education. Journal of Engineering Education. 48 (March, 1958) 573-576.

GRINTER, L. E. "A Survey of Changes That Are Modernizing Engineering Education." Journal of Engineering Education. 49 (March, 1959) 559-572.

HANCHER, V. M. "Liberal Education in Professional Curricula" Journal of Engineering Education. 44 (March, 1954) 356-361.

HOLSTEIN, EDWIN J. and EARL J. McGRALK. Liberal Education and Engineering. New York: Bureau of Publications, Teachers College, Columbia University, 1960.

JOHNSON, J. STUART. "The Integration of Humanities into an Engineering Program." Journal of Engineering Education. 45 (June, 1955) 805-806.

KITZHABER, ALBERT R. *Themes, Theories, and Therapy: The Teaching of Writing in College*. New York: McGraw-Hill, 1963.

LANDIS, FRED. "An Engineering Teacher Looks at the Humanities Program. *Journal of Engineering Education* 48 (March, 1958) 568-572.

MacKAYE, MILTON. "How to Humanize a Scientist." *Saturday Evening Post.* 227 (April 23, 1955) 40-41.

MILLER, HERBERT. Liberal Education and the Engineering Profession. *Journal of Engineering Education*. 51 (October, 1960) 39-42.

OBLER, PAUL AND HERMAN A. ESTRIN. *The New Scientist: Essays on Methods and Values of Science*. New York: Doubleday, 1962.

ODIORNE, GEORGE S. "The Trouble with Engineers." *Harper's Magazine* 210 (January, 1955) 41-46.

PECK, JOHN S. "Does the Engineer Need Culture?" *American Association of University Professors*. 32 (March, 1956) 51-56.

STEINBERG, ERWIN R. "Who am I and Who Are You?" *Journal of Engineering Education*. 50 (April, 1960) 650-653.

STRATTON, J. A. "Science and the Educated Man." *Physics Today*, 9 (April, 1956) 17.

WHIPPLE, WILLIAM, JR. "Arts and Sciences for Engineers" *Journal of Engineering Education* 44 (June, 1954) 644-648.

WHITLOCK, BAIRD W. "The Mark of an Educated Man" *Journal of Engineering Education.* 50 (April, 1960) 636-639.